JANUARY 1930

MACHINE DESIGN

AS IT AFFECTS

ENGINEERING–PRODUCTION–SALES

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ENGINEERING–PRODUCTION–SALES

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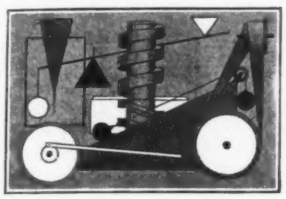

Volume TWO

WITH this issue MACHINE DESIGN *introduces its second volume. Wide and timely coverage of the field of design is assured to its readers during* 1930, *the intention of the publishers and editors being to maintain effectively the policies initiated in Volume* 1.

Those members of the design profession not included among the readers of the four issues of the first volume, will realize at a glance the practical and influential scope of the publication—and the invaluable service it is rendering to design—by scanning the index to Volume 1 *on pages* 67 *to* 70 *of the present issue.*

L. E. Jermy.
Managing Editor

CONTENTS

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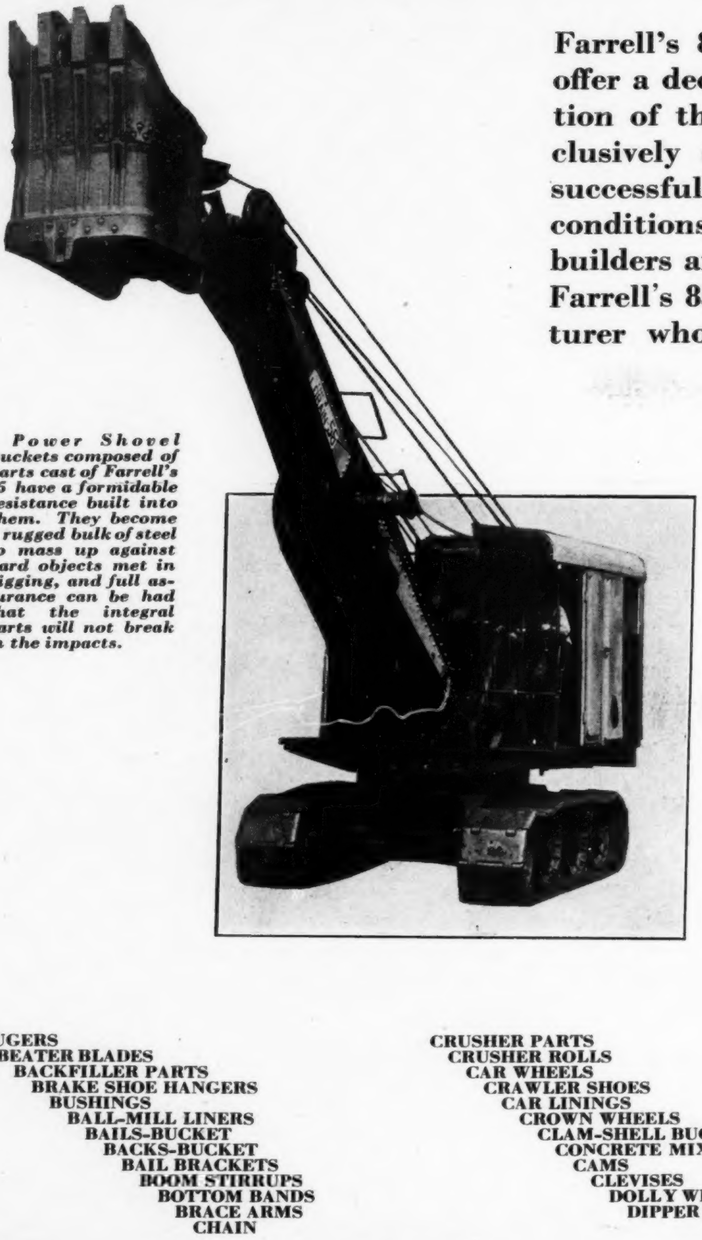
FARRELL'S 85



Power Shovel buckets composed of parts cast of Farrell's 85 have a formidable resistance built into them. They become a rugged bulk of steel to mass up against hard objects met in digging, and full assurance can be had that the integral parts will not break in the impacts.

Farrell's 85 is now enabling shovel builders to offer a decidedly longer service life in the operation of their digging buckets. Tests have conclusively shown that it is the steel that will successfully resist breakage under the most severe conditions in any type of digging. Many shovel builders are having their entire buckets made of Farrell's 85, and the confidence of the manufacturer whose shovel is illustrated on this page is shown by the fact that during the past ten months more than one hundred machines were equipped with either 1 yd. or ¾ yd. buckets composed entirely of Farrell's 85 castings. *And not one breakage reported!*

It is the inherent toughness and strength of the steel that provides immunity to breakage—to which is added the desirable property of extreme resistance to wear and abrasive conditions.

Farrell's 85 Steel Has a

AUGERS
BEATER BLADES
BACKFILLER PARTS
BRAKE SHOE HANGERS
BUSHINGS
BALL-MILL LINERS
BAILS-BUCKET
BACKS-BUCKET
BAIL BRACKETS
BOOM STIRRUPS
BOTTOM BANDS
BRACE ARMS
CHAIN

CRUSHER PARTS
CRUSHER ROLLS
CAR WHEELS
CRAWLER SHOES
CAR LININGS
CROWN WHEELS
CLAM-SHELL BUCKET PARTS
CONCRETE MIXER PADDLES
CAMS
CLEVISES
DOLLY WHEELS
DIPPER BAILS

DIPPER TEETH
DREDGE BUCKET PARTS
DRAW BARS
DISCS
DREDGE PUMP PARTS
DOORS
DRUMS
ELEVATOR BUCKETS
FRONTS-BUCKET
GEARS AND PINIONS
GRAB BUCKET PARTS
GROUSERS
GRIZZLEY DISCS

The Farrell-Cheek Steel Foundry Co.,

FARRELL-CHEEK

F·C F·C

*He who leans on Washington, D. C. leans on a rubber cane

By THEODORE F. MacMANUS
President, MacMANUS INCORPORATED
DETROIT

Business is only going to be good next year for those who make it good.

Sales will not be poured out of a cornucopia into the laps of the undeserving.

They will be squeezed out of a tough tube a sale at a time.

Leaning on Washington, D. C.—not necessarily the Washington of this moment but any Washington at any time—is like leaning on a rubber cane.

Of all the great aids given to business by government, the greatest in all probability are the tariff and a sound money system.

But the surest way for any business to get the greatest good even out of these twin aids is to proceed as though they did not exist—as though the business did not derive a dollar's worth of benefit from them—as though its ultimate net profit depended entirely upon individual initiative and intelligent advertising.

Paternalism of bureaucratic aid is the rubber cane of Business.

Sane, sensible advertising is its strong right arm.

There is nothing vitally wrong with business but quite a good deal that is wrong with its management.

For instance, if the automobile business became top heavy in recent times, it was partly due to the fact that it was overweighted with swollen heads and swollen fortunes.

All of the Motor Companies had and have huge markets but what they wanted was not a huge market but a hog market.

Perhaps the worst feature of the recent upset is the fact that it gives guilty managements and feeble executives one more opportunity to enter an alibi.

Scores of busy little first, second and third vice-presidents, sales and assistant sales managers and profoundly wise advertising men are once more running around in a frenzied circle, explaining volubly that it was not their business which went wrong, but General Business.

Now they are clamoring for luncheons and banquets and pep meetings and sales conventions.

What is actually needed is not nearly so much a house-warming as in many, many cases a house-cleaning.

All branches of business could benefit by it and advertising perhaps most of all because advertising has been willroger-ing all over the premises for the past ten years.

During the ten or more years of our riotous prosperity, someone forgot to batten down the business booby-hatch and a number of the inmates escaped and climbed to high managerial places while no one was looking.

It is time for the Boastful Boys and the Braggadocia Brothers and the Smart and Fox Families to retire to deserved obscurity.

It is high time to stop taking ourselves seriously and begin to take Business seriously.

Advertising actually has a mission.

That mission has to do with people.

Its object is to inspire people with confidence—as a preliminary to selling them something with which they will be pleased.

To do this requires a great deal more than a master's degree in English.

It implies an understanding of the human animal, the social fabric, the business structure of the nation and the world, and—super-added to all of these—a wizardry of words and a gift of implication and suggestion greater even than the greatest power of outright statement.

Advertising is the word and the mouth, the literature and the voice of Business—and Business is the one great public heroism which is left to most of us in this work-a-day world.

It behooves business for 1930 to look to itself—and especially to look to its advertising with a microscopic eye of critical and appraising examination.

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MACHINE DESIGN

January *1930*

Reciprocating Parts Eliminated In Design of Folding Machine

By Lesley R. Tufts

IN THE printing industry there are several examples of the advantages to be derived from employment of the principle of continuous, uninterrupted production by means of rotary motion. The result obtained by this method in the rotary newspaper press is well known to most engineers.

Another instance of these advantages is shown in the paper folding machine built by a large manufacturer of this type of equipment. The machine is used for folding individual sheets of paper after the printing operation. A machine for this purpose, to meet the requirements of the printer, must be able to make numerous styles of folds including those used in book bindery, catalog work and letter folds, as well as the vast variety of advertising circulars. It must be adjustable readily to any size sheet within its capacity.

Two distinct machines are used as part of the complete operating unit, each designed around the principle of rotary action: first, the feeder which automatically separates the sheets of paper and feeds them into the folder; second, the folding machine which folds the sheet into the required form. An illustration of the complete machine is given in Fig. 3.

In the design of the feeder an air blast is employed for separating the top sheets from the pile on the support table. This blast is so arranged that a continuous stream of air is directed against the forward upper edge of the pile, in

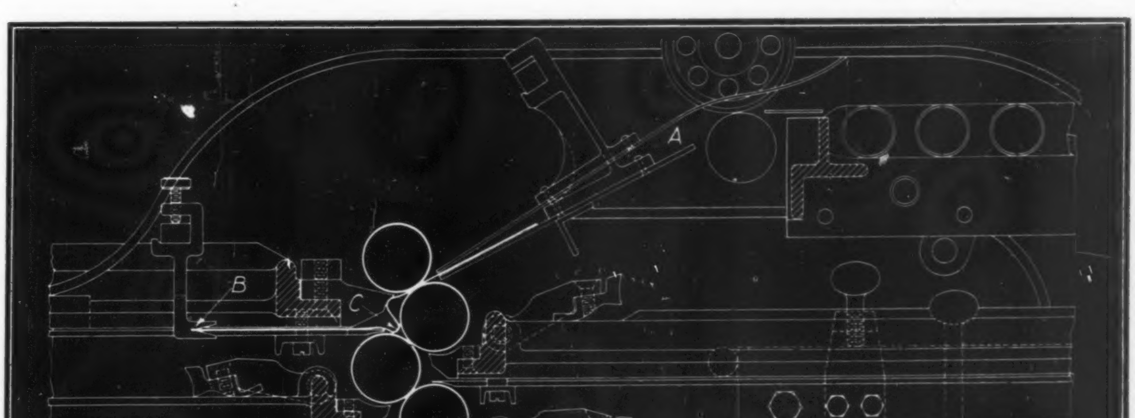


Fig. 1—First folding section of machine. Note at C how fold is formed

Fig. 2—Air blast floats sheets toward suction drum

order that the top sheet may be "floated" until the uppermost sheet comes into contact with and is gripped by, the suction drum illustrated in Fig. 2. This drum is shown in the action of feeding the sheet into the folding machine proper. Continuous blast and suction are used so that the upper sheets of the pile are always floating and as soon as the end of one sheet has passed, the front edge of the next sheet is gripped by the suction drum and fed forward.

By this method of feeding, a continuous stream of single sheets can be maintained regardless of the size of the sheet. It will be appreciated that if a reciprocating, or timed feed were employed it would be impossible, unless numerous changes were made, to feed different lengths of sheets in this continuous manner. An adjustment of the speed of the suction drum in relation to the speed of the folder is provided to permit only the minimum requisite amount of spacing between sheets.

One Pump Serves Two Purposes

For both the suction and blast the same rotary pump, suitably connected, is employed, and valves with outlets to the air are provided for regulating the volume of the blast and the intensity of the suction.

In order to overcome the difficulty caused by unequal suction across the face of the suction drum the holes around the drum are made smaller in diameter near the suction pipe connection and gradually larger as the distance from the pipe increases. This can be noted from Fig. 2.

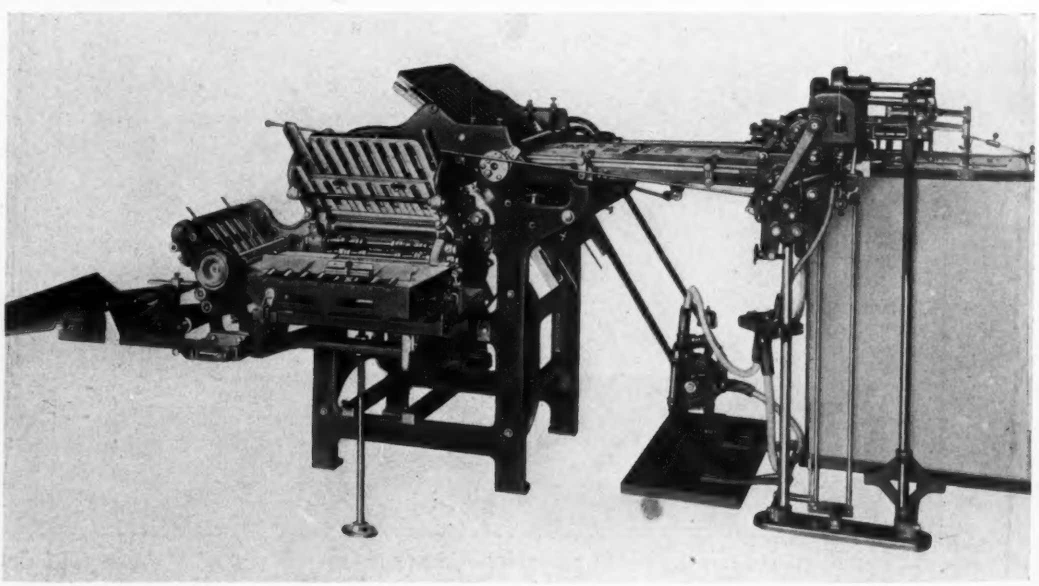
Paper Height Is Maintained

As the paper is being fed forward it is essential that the height of the pile be maintained at a predetermined level in order that there shall be no interruption in the feeding of the paper. This is accomplished automatically by the mechanism depicted in Fig. 4. Lever *A*, which is known as the testing lever, controls the height. At the end of the lever there is a roller which intermittently makes contact with the paper and tests the height when cam *C* permits the lever *B* to fall. When the height of the pile is reduced to a certain level the downward extending arm of lever *B* comes into contact with the latch lever *D* at its lower extremity. The upper extremity of this lever throws over to a position in the path of the ratchet arm *E*, this arm being actuated by the crank *F* through a connecting rod and the rocker arm *G*.

It will be seen from the drawing that on the downward stroke of the ratchet arm *E*, the ratchet is tipped into contact, by the latch lever *D*, with the ratchet wheel *H*. This wheel is keyed to a worm shaft, and rotation of the worm, working through a worm wheel, to a series of sprockets and chains, lifts the pile support table attached to the chains.

All engineers and designers who have been engaged in work presenting similar problems to that of feeding paper, from a stack, have encoun-

Fig. 3—Illustration of folding machine. Stack of paper can be seen on support table at right. Note angular setting of the feed rolls on third folding section in foreground



tered the difficulty of having more than one sheet feed forward at the same time. In the case of feeding paper, trouble is often caused by an excessive amount of ink in the printed matter; torn or bent edges, or an excessive amount of static electricity, which is always a source of annoyance to the engineer in the handling of paper. Any of these conditions may cause the sheets to stick together.

Incorrect Feeding Stops Machine

In this machine a solution was found in an automatic device which stops the feeding mechanism as soon as two sheets are fed forward simultaneously. This mechanism is shown in Fig. 5. As the paper is fed forward by the suction drum it passes over an accurately ground roller *A*, immediately above which is mounted a quadrant *B*. This quadrant is mounted adjustably and set with the necessary amount of clearance above the roller *A* to permit only one sheet to pass through. If two sheets are fed at one time the quadrant is rotated against the finger *C*, this in turn rotating the shaft *D* upon which the finger is mounted. Rotation of the shaft actuates a series of levers and connecting links, and causes a wedge *E* to be interposed between the friction disk *F* of the feeder, and an abutment. The face of the wedge is covered with a friction material so that when it comes in contact with the rotating disk the friction set up draws the wedge downward into a position such that the disk is pushed away from the friction driving roll *G*. This disconnects the feeding mechanism from its source of power and also acts as a brake, thus stopping the feed before the two sheets have been permitted to enter the folding machine.

After a sheet of paper has been fed forward and before it enters the folding mechanism it must be positioned accurately in relation to this mechanism. The table upon which the paper passes consists essentially of a series of rollers set at an angle to the normal line of travel and rotated by a small flat belt. The angular setting of the rollers carries the sheet over to, and holds it against, a side rail which positions it and guides it into the fold rolls. In the case of folding machines which do not employ the principle of continuous rotary operation this is accomplished by conveying the sheet to a stop, then by suitable reciprocating mechanism which draws the sheet to one side until that edge is in a definite position, and then releasing the sheet allowing it to travel on into the machine. The speed at which the reciprocating parts can function properly is limited, and when the sheet is held stationary while being positioned, time is lost.

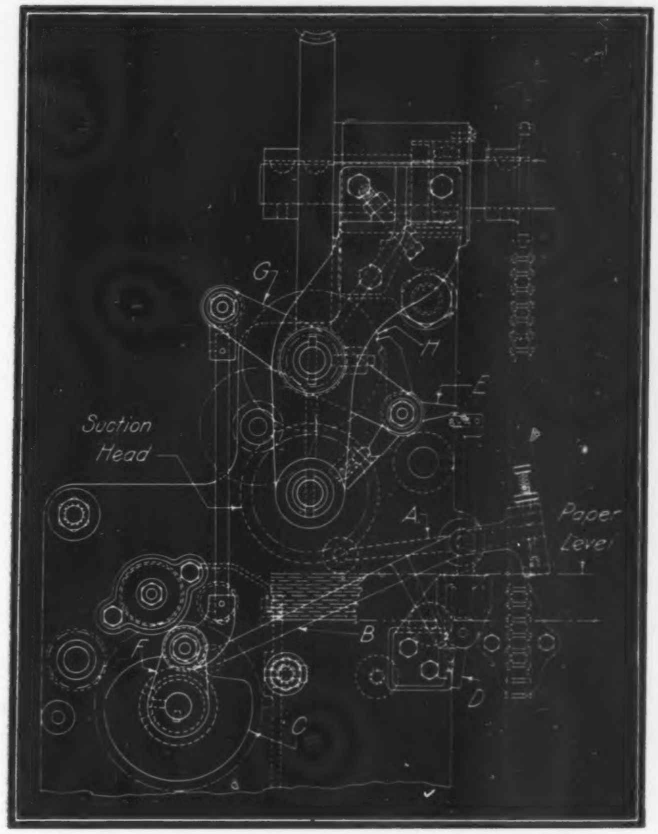


Fig. 4—Mechanism for keeping paper at same level

In order to make all of the numerous folds required, the machine is divided into several folding sections, each set at right angles to the preceding one and each consisting of one or more folding units. In certain instances the first folding section is required to make as many as four folds and this necessitates an arrangement of rolls such as is shown in Fig. 1. In feeding through these rolls the sheet passes from the angular roller feed table down chute *A*, and thence through the two upper rolls until its forward edge is prevented from traveling further by the stop *B*. Continued feeding of the paper causes a buckle or loop to be formed as indicated in the drawing at *C* and this loop is guided into the grip of the second and third rolls, thus completing the first fold.

Many Folds May Be Made

Subsequent folds are made in a similar manner, stops being provided on each of the fold plates. In the drawing these plates all are shown in the operating position. However, each can be made inoperative by the use of the deflectors which are thrown back in the illustration. To maintain a positive and uniform grip on the sheet as it passes through the fold rolls with as little contact as possible to avoid marking, each roll is provided with a spiral. The spiral has an advantage over a straight grooved roll in that it grips the sheets positively and at numerous points

across its width, thus insuring accurate alignment of the sheets. A fine knurl is employed to provide sufficient intersecting points of contact.

Steel Balls Solve Pressure Problem

A novel use of steel balls is made throughout the feeding sections of the machine. The light weight of the paper sheets resting on the feed rolls at times is insufficient to provide the amount of friction necessary to feed the paper at uniform speed. On the other hand any slight excess of weight on top of the sheet would be apt to cause buckling or crumpling. It therefore was essential to employ a method which, while being positive, also was sensitive, and the steel ball furnished the solution to this problem. If the weight of the steel ball is found to be too great for thin paper, glass balls are used. Holes of a suitable diameter are drilled in a flat plate which is mounted about one quarter-inch above the level of the feed rolls. The paper is fed in a slantwise direction toward the guide due to the angular setting of the rolls but before the paper edge comes into contact with the side rail it lifts the balls and passes under them. Being immediately over the axes of the feed rolls the balls maintain sufficient pressure to provide the necessary friction and yet, having rolling point contact only, do not interfere with the smoothness of the feed or the alignment of the paper.

The use of the balls is particularly effective when the direction of the paper is changed through a right angle after passing through the first folding section. See Fig. 3. A small feed roller is provided at the end of this section in order that the folded paper will practically reach the next side guide before it starts to travel at 90 degrees. This feed roller sends the paper almost under the balls, and the angularity of the feed rolls finally accomplishes this, bringing the edge of the paper against the side guide in the manner explained previously.

After passing through the requisite number of folding sections the papers are stacked by being passed onto a slow moving belt above which is mounted a stop at the correct height to allow one folded sheet to pass under. The speed of the belt permits each circular, bookform, or whatever has been folded to overlap the next. They are then carried along a certain distance toward a sloping tray down which they slide and become stacked automatically.

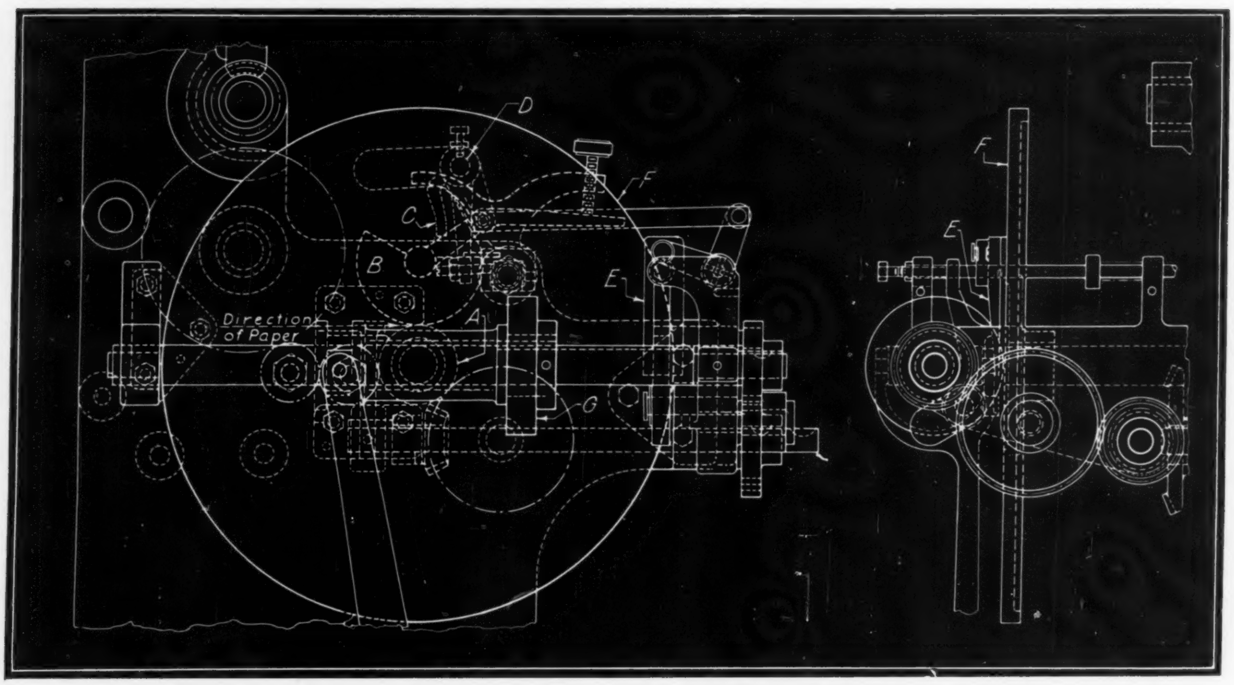


Fig. 5—Automatic device which has been designed to stop the machine if two sheets feed forward at the same time

Machine Gives High Production

With this type of continuously operating rotary motion a production of from 3000 to 3500 folded sheets 50 inches long can be obtained in an hour, and without changing the speed as many as 12,000 to 15,000 sheets 12 inches long can be folded in a similar period.

SCANNING THE FIELD FOR IDEAS

A Monthly Review of New Machinery, Metals and Parts, with Special Attention to Significant Design Features and Trends

Lubricating Car Chassis by Pump—Developments in Two Stroke Engines—Non-Resonant Gear Appears—Motor and Speed Reducer Combined—Borer of Great Size

IT IS an old axiom that the simplest design is the best design. The truth of this statement never was more generally recognized than it is today, when on all sides we find evidence of efforts on the part of engineers to put commonplace forces to work to serve their needs. This idea is illustrated in a new and somewhat revolutionary lubrication system recently announced by the Alemite Corp., Chicago. The new method is being adopted primarily for automobile chassis lubrication, advantage being taken of road vibrations, even though slight, to operate the pumping unit through an "inertia weight."

An illustration of the pump, the glass bowl of which has a capacity of almost a quart, is given in Fig. 1, with metal cap removed. The weight under the cap responds by oscillation to movements of the car, and the rougher the road, the more oscillations occur. A floating plunger operating inside a brass tube connects the weight to the pumping unit in the bottom of the glass bowl. Oil enters through an intake port, and as the weight falls the small diameter plunger forces the oil past two check valves.

Fig. 1—Pump used for centralized chassis lubrication

The pressure maintained by continuous pumping sends oil to all lubricating points of the chassis, one drop of oil being discharged at the pump for about forty or fifty strokes of the plunger. One adjustment screw is provided for varying the amount of oil pumped.

To proportion the oil correctly for the various points of lubrication, a resistance unit is provided at each bearing. The units contain a spiral grooved passage, through which the oil must pass. Although the resistant units are small, the use of a spiral groove permits of a long passageway equivalent to a very small tube having a fine bore, and about eight inches in length. The resistance of this groove is such that a pressure is built up in the entire system.

Outboard Motor Has New Features

THE importance of smoothening out torque and reducing vibration in pleasure equipment as well as in machinery, has been appreciated by the Johnson Motor Co., Waukegan, Ill., in the development, for the first time in the history of outboard motor boating, of a successful twin cylinder motor in which the cylinders fire alternately. The engine is of the two-stroke type and two impulses therefore are produced per revolution instead of one as heretofore. A cutaway section of one of these engines known as the Johnson company's "Sea Horse," models 4 and 12, is shown in Fig. 4. The rotary valve—an entirely new departure in two-stroke motor design—which in the case of both these models is integral with the crankshaft, can be seen clearly.

Another improvement in the new engines is the combination of full pivot steering with the underwater exhaust. When the

HOW MACHINE DESIGNERS ARE MEETING

Fig. 2—General view of outboard motor, showing underwater exhaust port

DEVELOPMENTS in the field of outboard motor boating are exemplified in the two-stroke engine shown below, and described on page 19. The rotary valve is integral with the crankshaft and the pistons are in line instead of opposed as in earlier models.

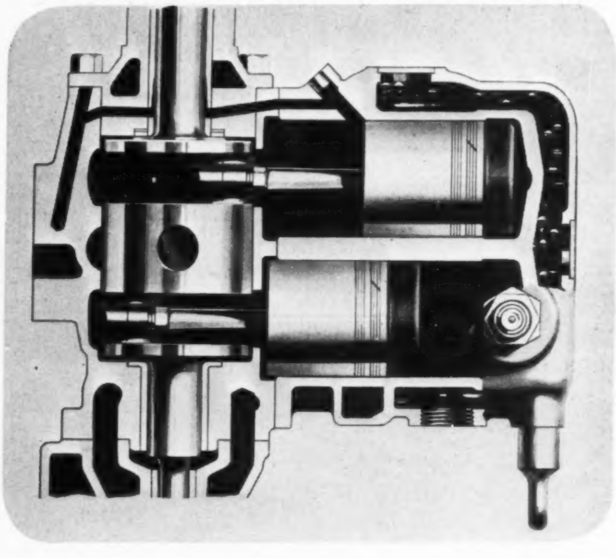


Fig. 4—Sectional view of new outboard motor

WATER pressure from the vacuum cooling system of the outboard motor is utilized to open and close the valve shown below automatically, in accordance with speed of engine. Inset shows exterior view.

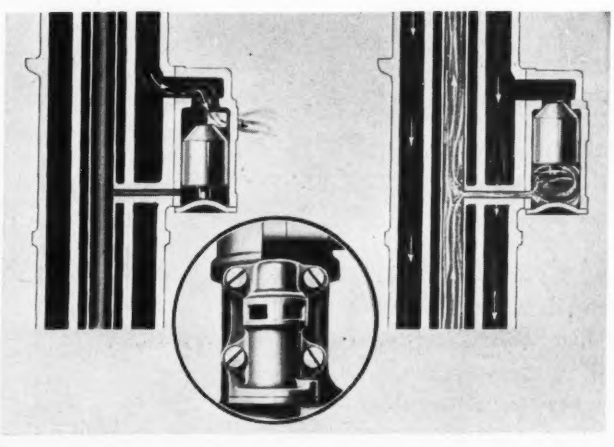


Fig. 5—Three views of automatic relief valve

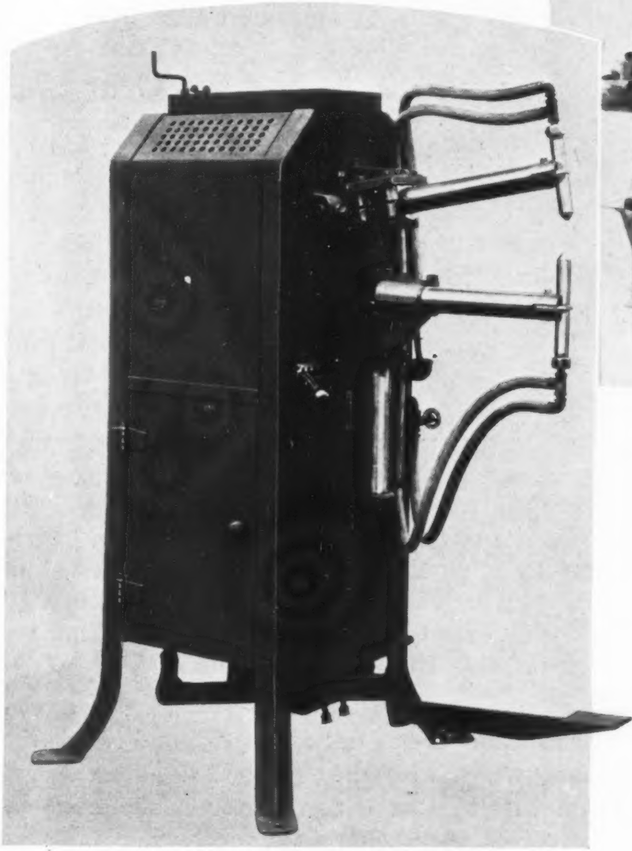
Fig. 3—New non-resonant gear

RESEARCH and experiments have brought about the development of the non-resonant gear shown at the left, and described on page 22. It is hard to forecast the effect of such sound elimination experiments on design.

THE NEW REQUIREMENTS OF INDUSTRY

STRUCTURAL angles comprise the entire framework of the spot welder shown below. It was fabricated by the arc welding process, and is indicative of the increased employment of this method of manufacture, particularly for machines where light weight is an advantage. The machine was built by the Cincinnati Welders Inc., Cincinnati.

Fig. 6—Construction of spot welder



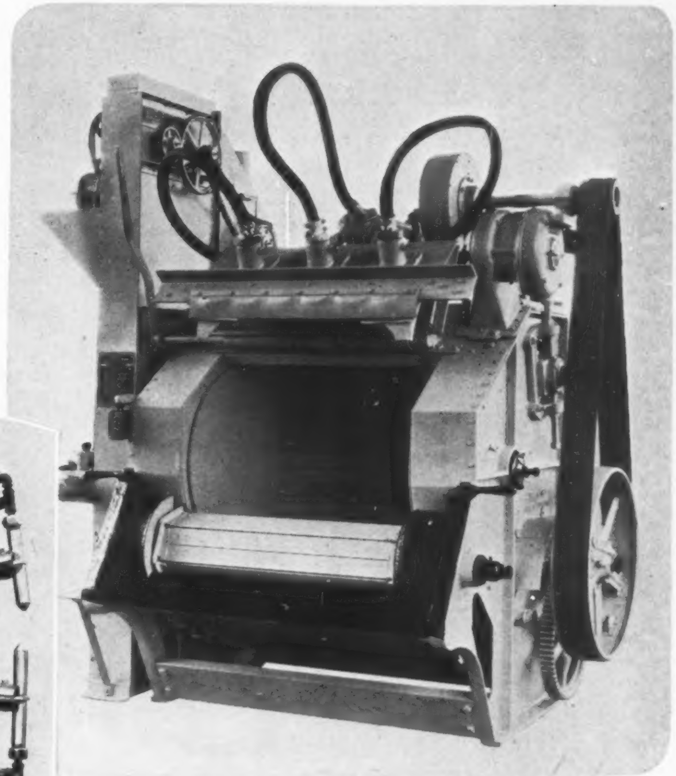


Fig. 8—Novel sand blasting machine

WORTHY of note is the semi-barrel type of conveyor used in the machine shown above, built by American Foundry Equipment Co., Mishawaka, Ind.

THE unique locomotive shown below was built in England at the London & North Eastern Railway works, and has a watertube boiler giving a pressure of 450 pounds per square inch. The chimney is sunk within the casing.

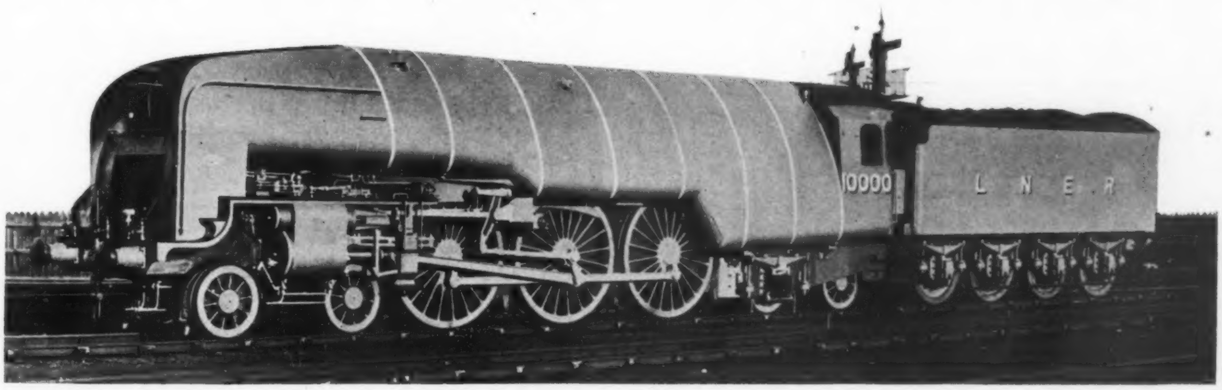


Fig. 7—New giant locomotive, claimed to be the largest and most powerful in Britain

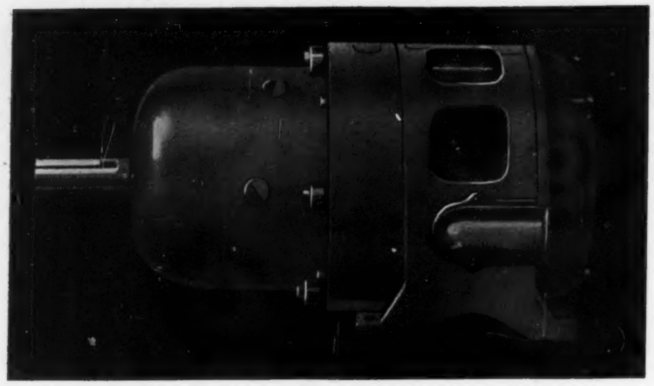


Fig. 9—*Speed changer in which the reduction unit is built as an integral part of the motor*

latter originally was adopted an extra exhaust pipe prohibited full pivot steering. The exhaust pipe, however, now is enclosed in the single drive shaft casing thus permitting a full steering range, and reverse. The under water exhaust is significant in that the suction created behind the exhaust port when the craft is in motion assists in clearing the exhaust gases. At the same time noises and fumes are eliminated.

The design includes an automatic back pressure relief system which opens and closes the cutout valve to relieve back pressure. Three views of the new valve are shown in Fig. 5. It is operated by water pressure from the vacuum cooling system, this closing the valve at high speeds and opening it at low. The underwater exhaust port can be seen in the general view of the motor, Fig. 2, immediately above the propeller.

Speed Reducer Combined with Motor

NOT only is the grouping of machines for the "continuous operation" method of manufacture being carried out to an increasingly larger extent, but smaller units considered in the past as separate and distinct also are being built as complete products. An example may be found in the electric motor and the speed reducer; whereas these usually have been manufactured as separate units, one company now is combining them. This product, known as the Crocker-Wheeler speed reducer, is illustrated in Fig. 9. The speed reduction unit is built onto the end of the motor as an integral part.

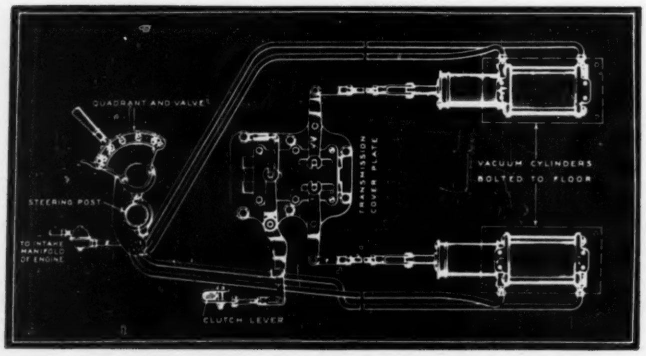


Fig. 10—*Diagram of vacuum gear-shifting device*

This reduction unit differs from the more conventional type in that it does not incorporate gears or chains in its internal mechanism. Instead, it operates by rolling contact between hardened and ground steel surfaces pressed together firmly to eliminate slippage. The speed reduction is obtained by the planetary method, and the claim is made that the mechanical efficiency of the device is higher than that of any other form of speed changer. The unit is particularly adaptable to direct connected application.

Vacuum Employed for Gear Shift

ARE we shortly to see the elimination of the automobile gear shift lever? Many attempts already have been made to affect the changing of gears by systems controllable at the steering wheel but these early efforts were not sufficiently successful for commercial adoption. Of these systems, one was an electrical method, another a mechanical and a third, vacuum. All operated in a somewhat similar manner in respect to the actual gear changing. A hand lever was provided on the steering column, above or below the wheel, for setting in correct position for the gear to be used next. Part-way depression of the clutch pedal actuated the clutch, and the remainder of the throw shifted the gear. With the electrical method, solenoids were employed to accomplish the shifting.

Recently a new vacuum system was announced which has been designed as original car equipment but which also may be added as an accessory. In this system a distributor is mounted on the steering post below the wheel where a lever can be operated by finger pressure, without removing the hands from the wheel, to control the gear changing. Vacuum is carried by a system of tubing, connected with the engine intake manifold, to the steering post and then to each end of two vacuum cylinders which actuate the transmission forks. Fig. 10 shows the new shift.

Non-resonant Gear Is Developed

ONE of the factors entering into the design of machinery is the elimination of noise. It is interesting therefore, to observe that a considerable amount of research and numerous experiments have been carried out recently in con-

nection with the resonance of gearing. This becomes more important as the speed of machinery increases, a limiting condition of speed often being the amount of vibration and noise.

Among the experiments made by the General Electric Co., Schenectady, N. Y., to overcome gear resonance may be mentioned the following: (1) Inserting cork rings in grooves in the hub and rim of gear; (2) coating the gear with heavy compound; (3) the use of circular grease grooves under the inside of the rim; and (4) inserting, and welding in place, cold rolled rods in semicircular grooves on the under side of the rim. Each method gave more or less satisfaction but the last named proved the most successful and was adopted for certain applications. An illustration of the new gear is shown in Fig. 3, in which the resonance deadening rod may be seen.

This brings up the question: "If resonance can be deadened effectively by such a simple expedient, should it not be possible, by the utilization and extension of similar methods, to eliminate much of the noise of the machine shop or the production floors of factories? If for no other reason this might be considered by designers as a means for improving the working conditions—and in consequence the efficiency—of producers.

Two Machine Tools in One

THE trend toward increased capacity, particularly with regard to prime movers, has been particularly noticeable during recent years. Steam turbines of 40,000 to 50,000 kilowatt capacity were considered extraordinary a few years ago, but it now is usual to hear of similar units manufactured both in the United States and abroad, having a rated capacity of 160,000 kilowatts.

Larger Machines Become Necessary

For the machining of the parts of such units it has become necessary to increase size of machine tools almost to mammoth proportions and in Germany, where the tendency for higher capacities seems to be most marked, several companies are producing these giant tools. An illustration of a boring mill capable of handling work 59 feet in diameter is shown in Fig. 11, this machine having been built by the Scheiss-Defries A. G., Dusseldorf, Germany, for the machining operations of circular parts of large hydraulic turbines.

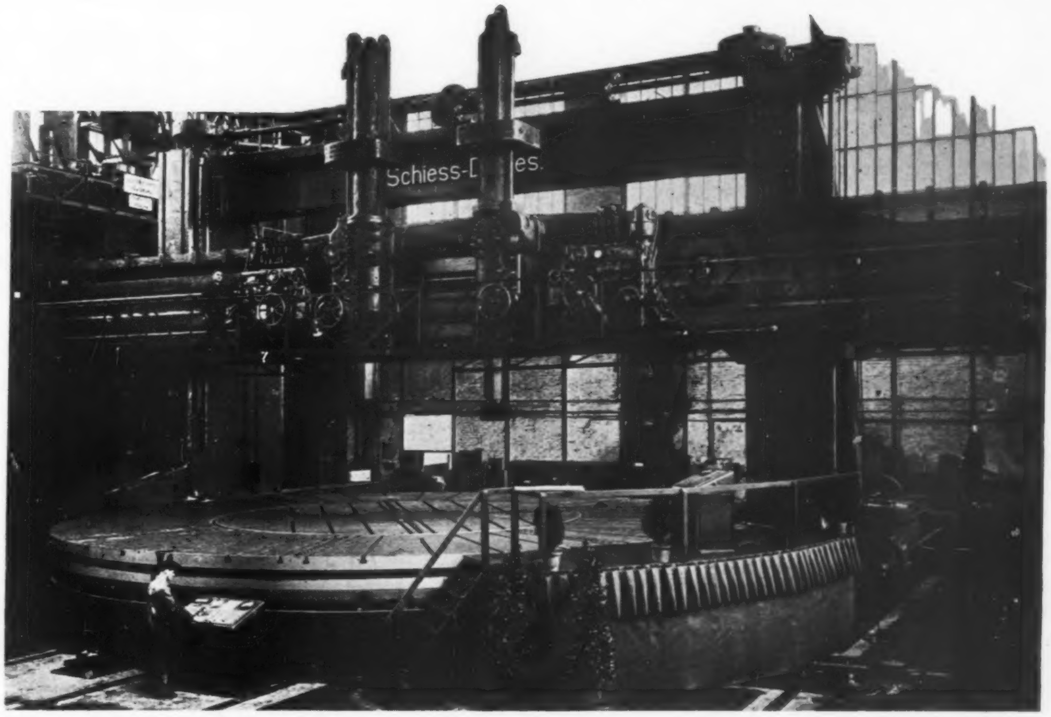


Fig. 11—Mammoth boring mill capable of handling work up to 59 feet in diameter. The table is divided so that smaller work, up to 21 feet in diameter, can be machined without revolving the complete table

A serious difficulty in the employment of such a machine naturally arises due to the comparatively small number of parts of maximum diameter to be machined. To put the tool on a paying basis it was necessary for it to be so designed as to be capable of handling much smaller work efficiently, and a solution was found for this problem by the incorporation of a smaller mill of 21 feet capacity within the large one. This divided the table concentrically into an inner disk and an outer annular ring, an independent drive being provided for the operation of each section of the table.

Lubrication Is A Salient Factor In Designing Machinery

By Allen F. Brewer

DEVELOPMENT of machinery which will function at high speeds with a remarkable degree of accuracy, has called for more and more consideration of the matter of lubrication and lubricating equipment on the part of the designer.

This is of special importance in view of the fact that the means of lubrication employed will be a criterion of the extent to which positive delivery of lubricants can be maintained. Obviously, in the interest of maximum production with the requisite degree of precision, lubrication must be dependable and positive. Any undue wear on bearings or gear teeth, for example, may throw shafting out of line, to interfere with accuracy of production and increase the power consumption.

IMPORTANT problems of lubrication are being solved with increasing success due largely to the progress which has been made during the past few years in establishing satisfactory methods, and in correct application. The progress in methods has given the designer of today the choice of many systems, all with characteristic advantages. Some of these systems are described in the accompanying article and others will be featured in later contributions to MACHINE DESIGN.

Lubricating equipment adaptable to industrial production machinery service must, therefore, be understood by the machine designer as well as the operator. The former, especially, must realize the capabilities and limitations of the several types of such systems available, for upon his realization of this will depend the extent to which ultimately successful performance can be maintained.

In the operation of the average machine, either grease or oil can be used, according to bearing design and location. Means of oil lubrication will be discussed in this article.

General Principles Involved

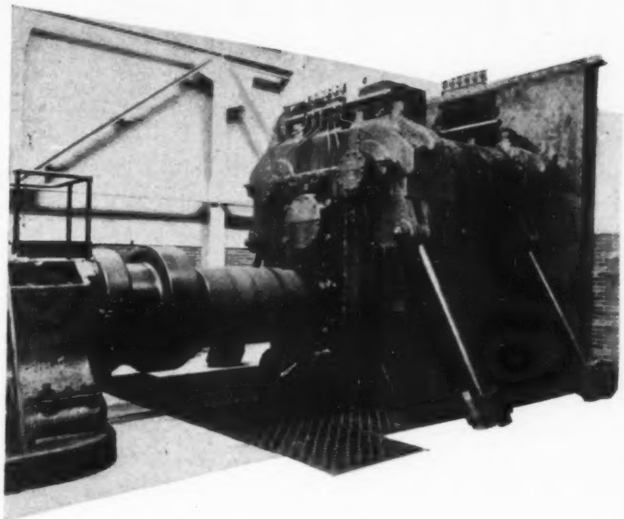
The trend in modern machine design is to provide for gravity or pressure lubrication according to the degree of dependability desired and the necessity for positive delivery of oil.

In this connection, it will be interesting to note that manual application of oils is becoming more and more superseded by automatic devices. This is especially true in certain types of machinery used in industries such as the textile, where oil drip may become a serious matter, due to the damage which may be done to goods in progress through the machine.

High-speed machinery also should be given considerable attention. It will be realized that operating speeds involve one of the inherent lubricating problems. As a general rule, the higher the speed the greater the necessity for the maintenance of a positive lubricating film in the respective bearings. It is practicable to bring this about either by the use of oil and the employment of an adequate circulating system where a number of such bearings are to be served collectively, or by individual lubrication, using a grease. Instances of the latter are the high-speed roller and ball bearings, so largely used in connection with certain types of wood-working machinery; by properly designing the bearing housings, the builders have enabled development of a positive and dependable lubricating film on all the moving parts of such bearings, with considerable economy of lubricant and the necessity of attention only at intervals.

Bearing Protection Study Important

It also is extremely important to study protection of the bearings in any industry where abrasive or contaminating matter may be developed in the course of working the product. Obviously, in an industry such as the cotton or wood-working, for example, there will be a certain amount of dust, fluff or wood particles, which,



TYPES OF LUBRICATION SYSTEMS

Fig. 1—(Above)—Sight feed lubrication applied to steel mill. Note oil cups leading to the respective bearings

Fig. 3—(Below)—One of the methods of centralized lubrication. Storage tank is above the machine and pedal pumping element on machine base at the right

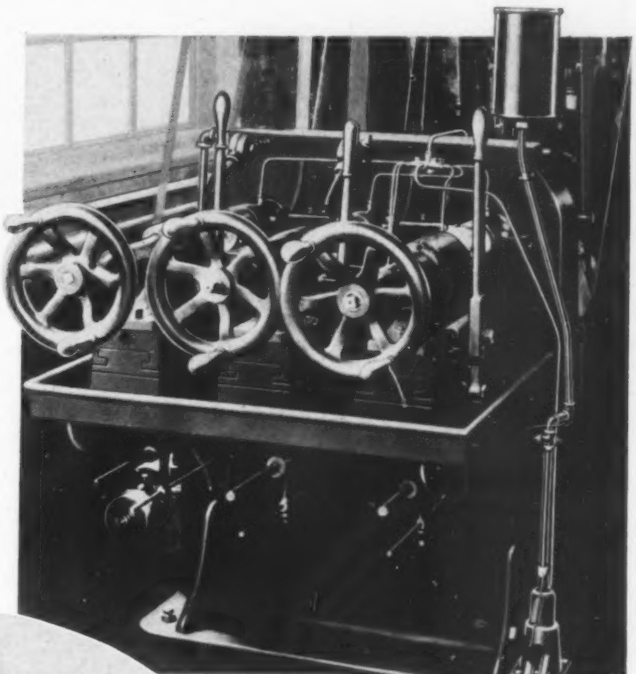


Fig. 2—(Center)—How oil is circulated at crank end of compressor. Crank bearing, connecting rod and guides are served.

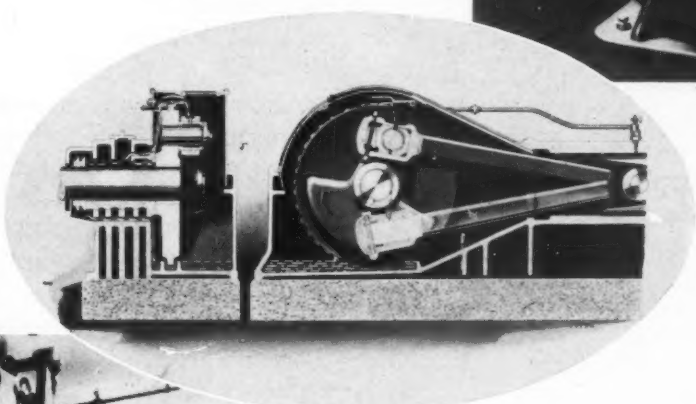
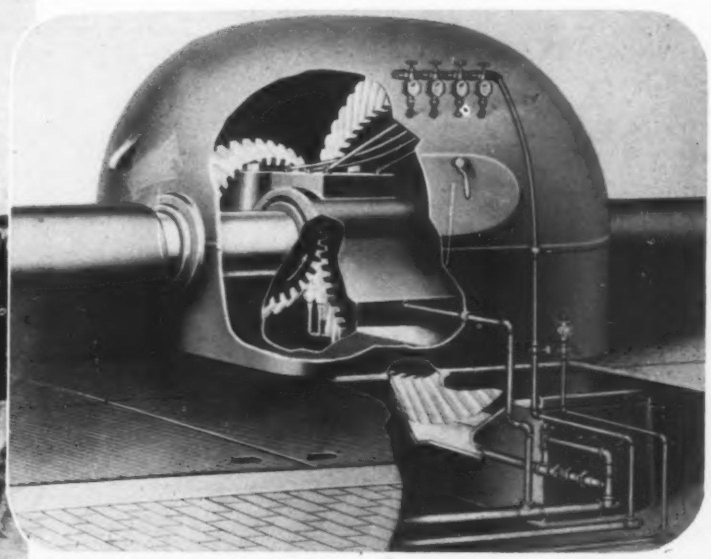


Fig. 4—(Below)—In this automatic circulation system, not only the bearings but the gear teeth are lubricated. Two streams of oil, as shown in illustration, are directed to point of engagement of the teeth



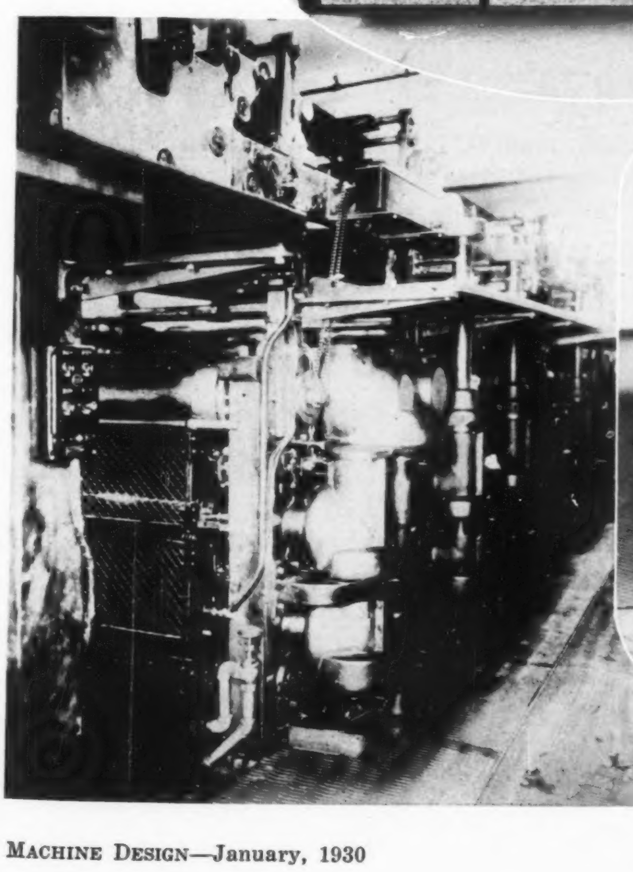


Fig. 5—(Left)—An instance of the application of centralized lubrication to the folder element in a newspaper printing press

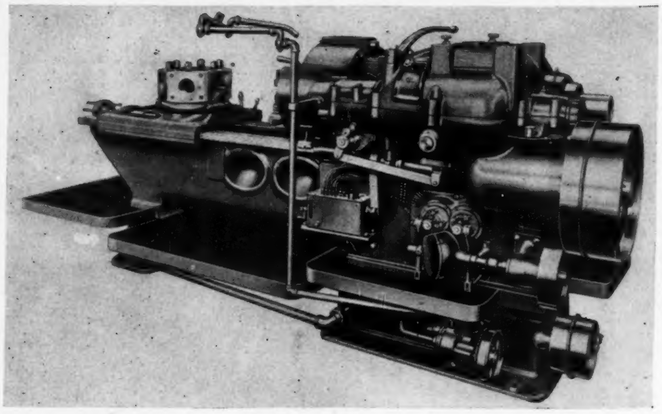


Fig. 6—Mechanical force feed lubricator applied to machine tool. Note accessibility of the unit

if allowed to collect in the lubricating system, might so fill up certain of the bearings oil grooves or piping as to materially decrease the flow of oil.

In turn, where metal working machinery is involved, it is needless to say that the presence of metallic particles in a lubricating system would score the moving parts and perhaps increase the amount of wear to such an extent as ultimately to necessitate renewal of bearings. Wherever wear is allowed to occur it is important to remember that the adjustment and accuracy of the attendant parts may be impaired. Accuracy and speed of production are important factors in the operation of any type of industrial machinery. Therefore such parts should be protected wherever possible by effective lubrication.

Development of Automatic Systems

In connection with automatic lubrication, the sight feed oiler deserves, perhaps, first attention, in view of the fact that it was one of the earlier developments along this line.

The sight feed oiler can be adjusted easily to deliver oil drop by drop to the bearings. It is, however, distinctly a gravity feed device, and in view of its usual location on the top of the bearing cap or adjacent thereto, it will apply but little external pressure to the oil film within the bearing. But providing the clearance space within this latter is sufficient to permit complete flow of oil, and that the oil grooves in the bearing cap and the chamfering of the edges have been properly taken care of, the sight feed oil cup will develop positive and dependable lubrication as long as it is kept filled with oil.

As a general rule it is well to remember that the sight feed oil cup is most adaptable to light or medium bodied machine oils, although where provided with an outlet orifice of sufficient size, it also can be made to handle oils as heavy as steam cylinder or light gear lubricants. This device, however, is distinctly a means of one-time lubrication. In other words, there usually will be no provision for the accumulation of oils for re-usage.

The sight feed oiler still is particularly adapted to lubrication of bearings and gears where such parts are accessible and where the operator has time to devote to careful adjustment of the rate of oil flow; certain textile and printing machinery can be effectively oiled with such equipment.

Pressure System Has Advantages

One-time lubrication also is involved in the mechanical force feed oiler. This device, however, has an advantage over the sight-feed oiler, in view of the fact that it is capable of developing considerable pressure. It is a decidedly dependable and economical device, for the rate of oil feed can more nearly be maintained at the right amount to give ample lubrication and yet with the minimum amount of waste. Furthermore, the pressure developed by such a lubricator enables maintenance of lubrication within smaller clearance spaces than would be practicable by use of the sight-feed oiler.

The mechanical force feed oiler usually is driven by the machinery which it is to serve, such as a newspaper press. As a result, it functions only when this latter is in operation and then only at a speed proportional to the operating speed. It is, of course, distinctly advantageous to employ in the textile, printing or metal working industries for example, a means of lubrication which does not require attention on the part of the operator when the machine is to be started or shut down.

The manner in which such lubricators can be driven will depend upon the connections possible

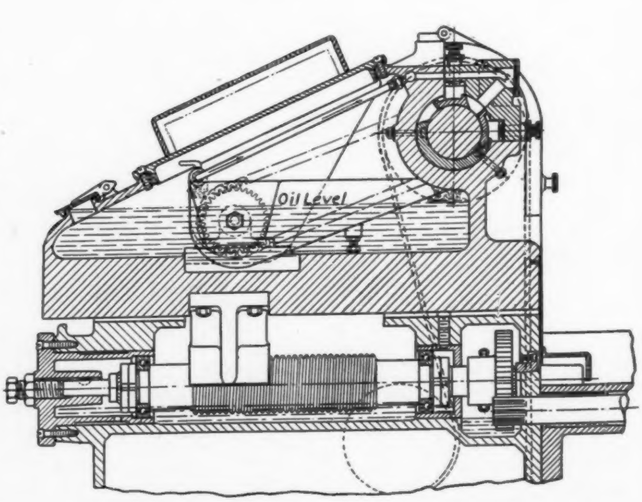


Fig. 7—Wheel side of grinding machine spindle case. Oil is pumped to bearings and returned to the sump

to some external part of the machine to be lubricated. Where reciprocating motion is involved, and where it is practicable to drive the lubricator by direct connection from some external moving part, a link mechanism or eccentric located on some rotating element can be used.

The adaptability of a mechanical force-feed lubricator frequently will be influenced by the oil consumption involved. If comparatively frequent refilling is necessary other means of oil delivery may be advisable, depending upon the extent of operation, the number of oil feeds and the rate of delivery. In general, this latter must be worked out in actual practice, according to the requirements of the parts to be lubricated, the nature and degree of refinement of the oil being used, and the design of the bearings.

Details of Mechanical Oiler

From the constructional viewpoint, the mechanical force feed oiler will involve an oil reservoir ranging normally in capacity from one pint to two gallons. The pumping element or block is located within this latter or attached thereto. To this element the operating ratchet, clutch or belt connection is attached, according to the make of the lubricator.

The type of pump employed will involve a piston or plunger. According to the duty, a number of such pumping units can be embodied in the one lubricator. This latter also can be divided into two or more parts so that more than one grade of oil can be handled. Where a lubricator of such construction is involved, care must be observed in filling to make sure that the proper compartment is charged with the proper grade of oil.

The pumping element is operated by an eccentric or cam which usually is located within the reservoir. Motion is received through the exterior operating mechanism such as the ratchet. A feature of such lubricators is that it is practicable to arrange the design so that each pumping unit can be operated independently. Individual regulation is thereby possible and is frequently advantageous, as for example on the newspaper press, brick machine, or textile loom, where oil delivery must be accurately controlled.

Sight Feeds Show Pumping Rate

Another feature is that rate of pumping can be observed through a suitable gage glass or sight feed device. By locating this latter in the discharge line observation of oil flow, after the lubricator has functioned, is possible. This enables the operator to estimate the extent to which lubrication is being maintained.

The built-in chain or gear driven pump will require careful study on the part of the machine designer, by reason of the extent to which its usage may affect the original design. The outstanding advantages of dependability and entirely automatic operation render such means of oiling especially useful on machinery involving complex gear and bearing arrangements, as do certain types of machine tools. A built-in oiling system is even more automatic than the mechanical force feed lubricator, for it requires no attention whatsoever from the operator, once it has been properly adjusted to develop the lubricating pressures required. These pressures can be varied according to the design of machine, and the operating temperature or viscosity of the oil to be handled.

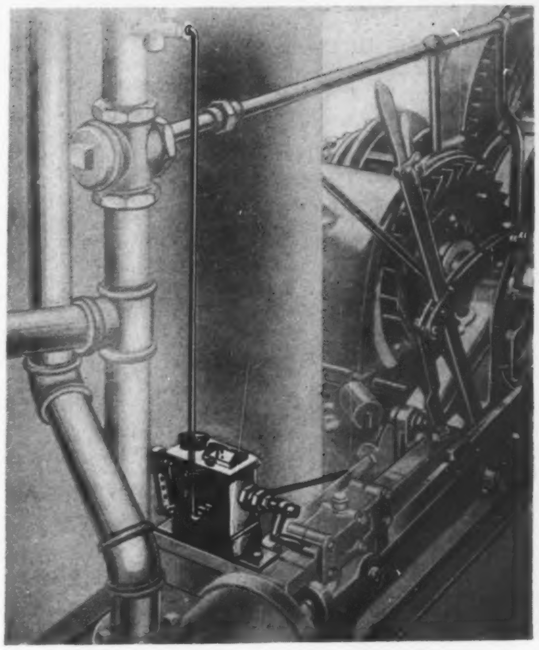


Fig. 8—Steam cylinder application of force feed lubricator

Different Types Are Suitable

In connection with industrial production machinery, such lubricating systems may involve either the gear and shaft driven pump, or the gear drive may be supplemented by chain and sprocket connections. The pumping element may be of either the gear or rotary type. Geared pumps are used for example in certain vertical reciprocating engines, whereas the rotary pump is employed to deliver oil to the bearings of some types of grinding spindles. However, regardless of the type pumping element, the pump itself must be located below the operating oil level in the base or sump of the machine or mechanism it is to lubricate. This will necessitate adequate storage capacity to permit of cooling and settling of the return oil, for with any system of this nature continuous circulation of oil is developed,

and more or less dirt and heat is taken up in its course through the system.

This is due to the fact that the oil serves as a flushing and cooling medium. By virtue of the pressure involved in circulation, and the volume of oil delivered to the wearing elements, this is, of course, a decided advantage, especially where external temperatures may be comparatively high or where a considerable amount of dust or dirt may be involved. The extent of oil contamination, in any case, will depend upon how dust-tight the system is, the speed of operation, the bearing pressures, and the proximity to other production or power equipment which may develop dust or dirt in the course of operation. The designer must therefore, bear this in mind when making his original design.

Built-in oiling systems also are provided with sight feed glasses adjacent to the parts to be lubricated in order to permit observation of oil flow. Frequently this flow can be controlled by installing suitable valves in each respective delivery line, thereby promoting economy where leakage may be apt to occur.

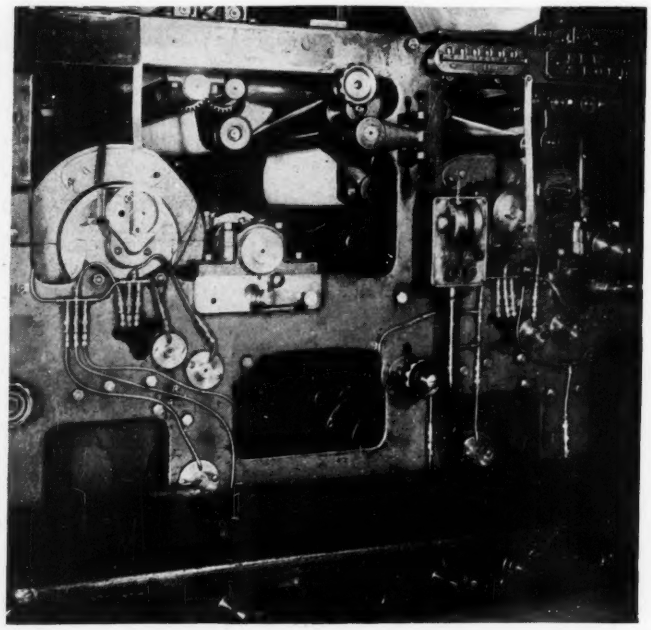


Fig. 9—In the lubrication of printing machinery, the mechanical force feed method has been found especially adaptable

A departure from the above mentioned devices which also provides automatic pressure lubrication, involves the so-called collective or centralized pressure systems which function by virtue of central control, the wearing parts to be lubricated being flushed and supplied automatically with oil from a central reservoir. Normally there is no operating connection to the machine to be served, and it is necessary to operate the pumping element by hand or foot power to deliver a fresh charge of oil throughout the system. Such systems of lubrication have been found adaptable to the newspaper press, certain types of machine tools and in the automotive and steel industries.

In this type of system the amount of oil supplied is restricted to as nearly as possible the theoretical lubricating requirements of the respective bearing, just as in the mechanical force feed lubricator. As a result it may be regarded as involving one-time lubrication.

Centralized Lubrication Has Advantage

Centralized pressure oil lubrication has a distinct advantage in that it permits of delivery of oil to bearings in accordance with the specific requirements of each. In other words, provision is made for regulation or control of the oil flow. In reality, this amounts to metering of the oil in its delivery. This can be brought about either by proper individual construction of the control outlets or drip plugs, by the use of suitable adjusting manifolds at certain points in the system, or by installation of a controlling device adjacent to the pump. Continued satisfactory operation can, therefore, be expected if all parts are of rigid construction and capable of withstanding jars, shocks and temperature fluctuations.

There is comparatively little possibility of entry of dust into such a system provided the installation is carefully made. To insure that clean oil is used, however, certain types of reservoirs are equipped with suitable filtering media, such as a felt pad, to bring about removal of any foreign matter that may have entered the oil in the course of storage or handling prior to circulation through the system.

Operating Pressures Must Be Considered

In considering any means of pressure lubrication, it is important for the designer to investigate the operating pressures which will prevail between the moving elements. This is especially true where one-time lubrication is involved, or in other words, where there is no provision for circulation of oil. Here pressure alone must be relied upon to maintain lubrication; therefore, whether a mechanical force feed oiler or a centralized pressure system is used, the oil must be delivered under sufficient pressure to withstand the operating pressures. In a circulation system, on the other hand, volume of oil is an added factor in the maintenance of lubrication, and in consequence, the pumping pressure will not require as careful consideration.

Timely Re-statement of Fundamental Mechanical Principles

By Prof. John V. Martenis, M. E.
Chief Machine Design Division, University of Minnesota

Power Transmission—Stresses in Shafting

SHAFTING is specified as to quality of material, method of manufacture and size. Although a number of materials may be employed, the final selection usually will be determined by considerations of cost and adaptability. The principal requisites for shafting material are strength and stiffness, which qualities are found in steels of "medium" grades. Since the modulus of elasticity for steel is independent of its hardness, as far as stiffness or rigidity is concerned, one grade of steel is as good as another. Strength qualities, however, differ through a considerable range and the designer must be guided in his selection by expediency.

Methods of manufacture further classify shafting as forged, turned, cold-rolled and drawn. Cold-rolled bars are produced with sufficient accuracy and smoothness for satisfactory bearing surfaces. The process of cold-rolling gives increased strength to the metal, but on the other hand it sets up internal stresses which may cause a warp in the shaft when the surface is cut.

Shafting Stresses

A shaft transmits power by torsion but in a horizontal position it is also subject to bending. The amount of torsion will vary directly as the horsepower and inversely as the rotative speed.

If conditions are favorable so that the shaft bearings can be placed close to the point of application of the bending load, the bending moments can be kept within narrow limits and in many cases taken care of by using suitable shear stresses.

A shaft which distributes power to a number of machines can be relieved of much bending stress by arranging to take the drives alternately from either side of the shaft.

A shaft may be strong enough to transmit a given power, yet it may respond to excessive angular distortion and thus be deficient in stiffness. This is a condition more commonly found in long shafts, which should be checked for stiffness as well as torsional strength.

Usually the forces which cause bending stresses in a shaft do not occur singly, for instance, a shaft carrying a belt driven pulley may be subject to a bending stress due to the belt pull and also to the weight of the pulley. The latter will in many cases exert an important influence on the final result.

A shaft subject to a reversal of bending stresses can be safeguarded by the use of a low working stress for the shaft material. Selection of a suitable working stress value will be influenced by the quality of the shaft material, character of the stresses to which the shaft is subject and the importance of the shaft in the transmission system.

Since the common method of expressing the power transmitted by a shaft is stated in terms of horsepower and revolutions per minute, it will be necessary in such cases to find the relation between them. As explained in an earlier article,

Fig. 1—Grapical method for determining bending stresses in a shaft

torsion is the product of force and its effective arm, or $P R$.

A general expression for work is force (P) times the distance (V) equals 33,000 $\times$ horsepower in which P is in pounds and V is the distance in feet per minute. Since the torsion will be expressed in inch-pounds and $V = 2\pi R N$, in which R is taken in inches, the relation becomes, torsion,

$$T = PR = 33{,}000 \times 12 \div 2 \pi N;$$

or $T = 63{,}025$ horsepower $\div N$.

for which average stresses for the shaft material may be used.

In all cases where there is evidence of wide ranges of fluctuation in torsion, it is advisable to check the maximum stress, using the found shaft diameter, to be assured that the elastic limit of the material is not exceeded.

Where a long shaft is considered, its stiffness also should be checked, especially if the power is received at one end and delivered at the other end of the shaft. If, however, power is delivered

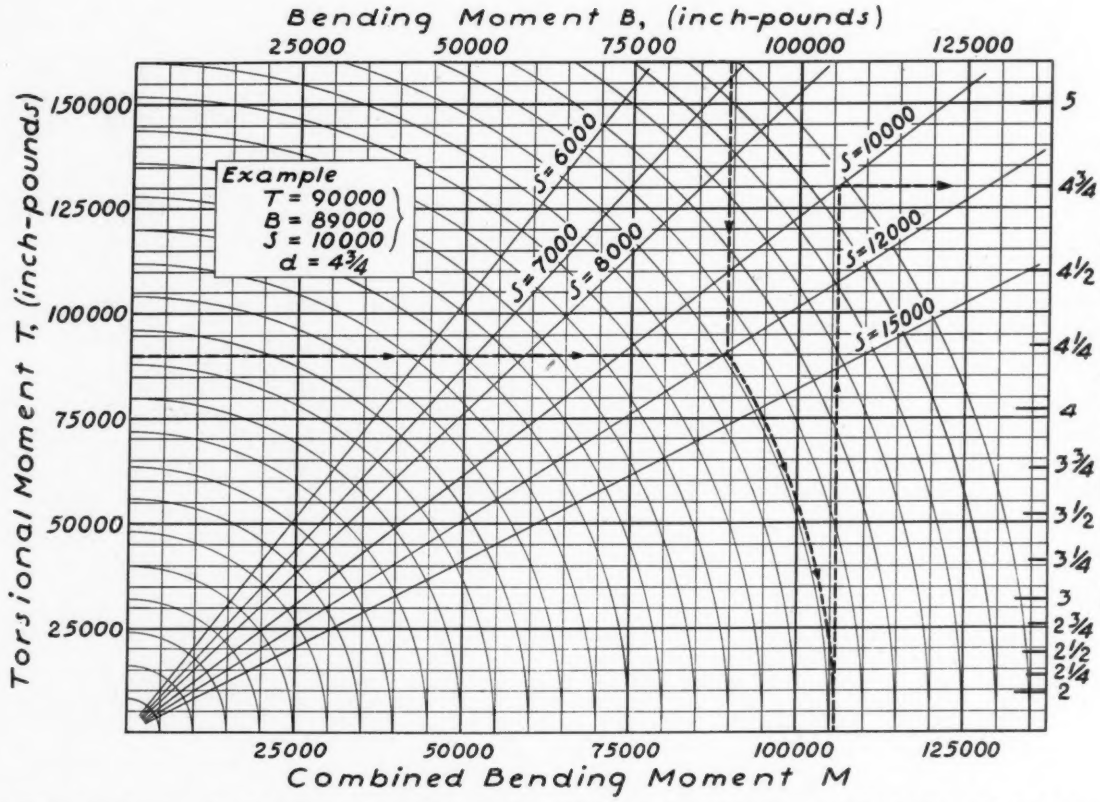


Fig. 2—Useful chart which may be employed for finding the diameters of shafts subject to combined bending and torsion

As developed in a discussion in an earlier issue,

$$T = \frac{S\, d^3}{5} \text{ or } d = \sqrt[3]{\frac{5\, T}{S}}$$

or substituting for T the value given above,

$$d = \sqrt[3]{\frac{5 \times 63025\ H.\ P.}{S\, N}}$$

These expressions for shaft diameter are based on torsion only and should not be used in cases where a significant bending action is involved, in which case,

$$d = \sqrt[3]{\frac{10\ B}{S}}$$

should be used. The torsion derived from the horsepower transmitted is the average torsion at various points along the shaft, there will be no serious difficulty caused by undue angular distortion, provided the shaft diameter is kept uniform throughout its length. As a check for torsional stiffness, the following relation can be used,

$$a = \frac{584\, L\ T}{d^4\ E}$$

in which a=angle of twist in degrees; L=length of shaft in inches; T=$P\ R$ or torsion; d=diameter of shaft in inches; E=shear modulus.

A much quoted rule states that, "It is common practice to limit the angle of twist to one degree for each 20 diameters in length." An example of the use of these relations may prove helpful; therefore, let us find the diameter of a shaft, 20

feet in length, to transmit 50 horsepower at 200 revolutions per minute. Assume the working stress in shear to be 6000; then $d=2.35$ inches, in which no allowance has been made for a key. Checking this shaft for stiffness, $a=6$ degrees, whereas the upper limit for this shaft is 5 degrees, therefore, checking the shaft for torsional stiffness, $d=2.45$ inches.

Shaft Bending

Cases arise in practice, in which a shaft is used primarily as a support and is subject to little or no torsion, for example, car wheel axles. In cases where bending is the all-important stress, the shaft diameter may be found by equating the maximum bending moment to the stress times the section modulus, or $B=S\ Z$.

The section modulus I/c in this case is $\pi d\ 3/32$. Substituting this value of Z in the general expression and using the approximate value of $\pi/32=10$, then

$$B=\frac{Sd^3}{10} \text{ or } d=\sqrt[3]{\frac{10\ B}{S}}$$

Comparing the expressions for shaft diameter based on torsion and on bending, it is apparent that bending action requires a larger shaft than the same amount of torsion.

There are many shafting problems in which there will be found two or more forces producing a bending action on the shaft and in such cases it will be necessary to combine these forces to determine their resultant. This can be accomplished in two ways, either mathematically or graphically. A graphical solution carefully executed will give satisfactory results, especially when an enlarged scale is used. The sketch in Fig. 1 illustrates a graphic solution of an example in which it is assumed a shaft is to carry a belted pulley weighing 100 pounds, also that the sum of the belt tension is 300 pounds acting at an angle of 18 degrees above the horizontal plane of the pulley.

Shaft Bending and Torsion Combined

Under the usual conditions of power transmission by shafting, there are relatively few cases in which torsion only or bending only are encountered. As a result of skillful layouts, the bending action can be minimized but its effect whether great or small must be considered in the final analysis. Under the assumption that the bending action will be relatively small, many designers apply the simple expedient of adjusting the working fiber stress in the torsion formula to take care of it. There are many cases,

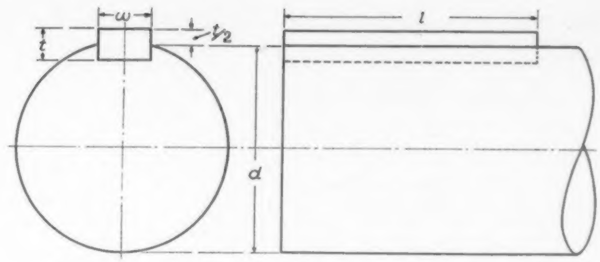


Fig. 3—Diagram showing parallel key discussed in text

however, in which the bending action plays an important part, which cannot be ignored.

A simple method of relating torsion and bending in combination has been presented in a discussion in a former article, where the resultant action was given in terms of a bending moment for which the bending moment formula obviously applies. In finding the diameter of a shaft subject to combined bending and torsion, and using a material in which the torsional and bending stresses bear a ratio of 8 to 10, the chart shown in Fig. 2 offers a convenient and rapid means for the solution.

To check the accuracy of the chart, the example solved by it was also determined by the bending moment formula, which gives a shaft diameter of 4.72 inches, which rounds out to the same size as found by the chart. In connection with the use of charts, it must be understood that the degree of accuracy obtainable is dependent on the scale and also on the ability of the user to interpolate values lying between given points.

Shaft Compression and Torsion Combined

This will be a case in which an axial loading is combined with torsion and the length of shaft is less than six times its diameter. Cases of this type may be found in certain forms of drill presses and in transmissions involving friction between two surfaces; in such cases a method of analysis analogous to combined bending and torsion may be applied. In setting up a relation between compression and torsion, the stress values differ materially from those used in combining bending and torsion (see table of physical properties of materials in earlier issue.) If it is assumed that the compressive stress is twice the shear stress, then it can be shown that the value

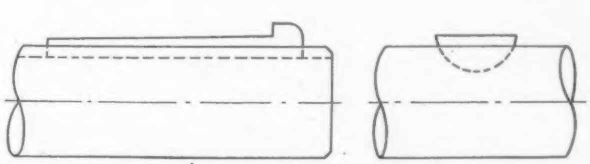


Fig. 4—Other forms of shaft keys

of K will be unity, whereas K in combined bending and torsion was 5/8.

Shafting Formulas (Empirical)

The diameter of a shaft to carry a given load may be determined either by a rational formula or by an empirical formula. When the rational formula is used, the key is provided for by adding a definite amount to the computed size of shaft, while in the empirical formula, the constant used will provide for the key.

The following empirical formula is widely quoted, and simple in application,

$$d = \sqrt[3]{C \frac{H.\ P.}{N}}$$

in which, $H.\ P.$=horsepower; N=revolutions per

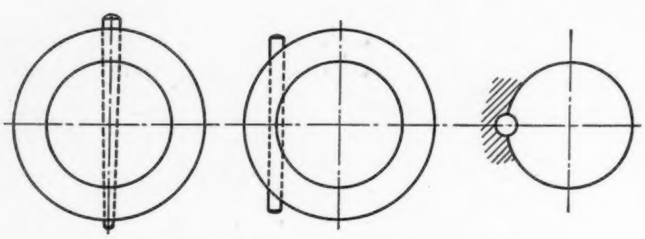


Fig. 5—Types of pin fastenings

minute; C=constant, as obtained from the following table:

	Turned shaft	Cold-rolled shaft
Head shaft	125	100
Line shaft	90	70
Counter shaft	50	40

For the determination of a shaft diameter, the stress used will vary with the importance of the shaft, the lower stress for the head or jack shaft. The following stresses may be used for materials of ordinary quality:

	Head	Line	Counter
Bending	5000	7500	10000
Torsion	4000	6000	8000

Shafting Keys

It is obvious that a shaft in which a key seat has been cut is weakened thereby and provision must be made to offset the weakness, which is usually done by increasing the shaft diameter. An old method provided for the weakening effect of a key seat by adding to the calculated diameter an amount equal to the thickness of the key; this procedure was based on the assumption that the key seat destroyed the effectiveness of the cut portion of the shaft so far as stiffness is concerned. In the light of more recent investigations, the old method was well on the side of safety.

The principal stresses to which a shaft key will be subject are shear and compression, therefore, the proportions of the key will be determined under the assumption that it will be equally resistant under both forms of stress action.

Referring to Fig. 3, let d=shaft diameter; w=width of key; t=thickness of key; l=length of key; S_c=stress in compression; S_s=stress in shear. Assuming that the force is applied at the shaft perimeter, then for shear, $P=l\ w\ S_s$ *and* for compression, $P=l \times \frac{1}{2}t\ S_c$.

Equating these expressions,

$$l\ w\ S_s = l \frac{t}{2} S_c \text{ or } \frac{w}{t} = \frac{S_c}{2S_s}$$

In certain grades of steel, $S_c=2\ S_s$ in which case $w=t$, or a square key would be used. To determine a relation between the width of key and shaft diameter equate the shear moment to the moment of resistance or

$$S_s wl \frac{d}{2} = S_s \frac{\pi d^3}{16}$$

and further assuming that

$$l = 1\tfrac{1}{2}d, \text{ then } w = \frac{\pi d}{12} \text{ or } \frac{d}{4} \text{ (approx.)}$$

Increases Compressive Stress

Commercial practice in many instances recommends for the proportion of sunk keys that the thickness $t=\frac{5}{8}\ w$, which practice requires the removal of less material from the shaft but increases the compressive stress relative to the shear stress.

Good practice often will use two or more keys rather than one, for two reasons: first, to secure a better stress distribution; second, to reduce the size of key and thus conserve the strength of the shaft.

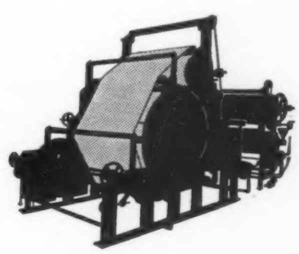
The distribution of the load carried by a key is dependent on the dimensions used, and in any event the length will be one of those dimensions; therefore, by increasing the length of the key the cross-sectional area may be reduced.

Investigates Antifriction Bearings

Investigation of the possibilities and limitations of heavy-duty antifriction bearings on rolling mills will be made by a committee of the American Society of Mechanical Engineers assigned to this department. A fellowship at the Carnegie Institute of Technology has made this work possible. Field tests will be made by the fellow, the reports of which will then be correlated and analyzed.

Design of Textile Machinery Shows Marked Progress

INDICATIVE of the trend in present day manufacturing methods is the use of range or in-train drives in finishing plants in the textile industry. Such developments are interesting not only to textile machinery designers but to those engaged in many other branches of the profession; they exemplify the trend toward increased adoption of the "continuous operation" method of manufacture, with resultant elimination of storage, idle time, and handling between machines. In the accompanying article this and other important phases of progress in the textile industry are touched upon. The article is based largely upon the opinions expressed in papers and discussions at the recent meeting of the textile division of the American Society of Mechanical Engineers.



DEVELOPMENT of improved machinery and employment of better manufacturing methods are playing a major part in the recovery of the textile industry. That designers of textile machinery are beginning to realize this fact and are awaking to the new opportunities thus afforded them is apparent from the report of progress in the textile industry, presented by the textile division of the American Society of Mechanical Engineers at the recent annual meeting which was held in New York.

In the efforts of the machinery manufacturers to obtain improved machine operation, there has been a search for improved materials of construction, the report indicates. Some of the newer materials such as those embodying artificial resins of the nature of bakelite have been introduced, and these have found their place in bobbins, spools, pickers, etc. In rayon manufacture, alloy metals have to a considerable extent replaced glass where acid-resisting qualities were required.

Marked increase in the output of rayon is in itself worthy of note, this output being estimated at close to 400,000,000 pounds for 1929. Much of the machinery used previously on other fibers is being converted to the use of rayon, while at the same time new machinery is being designed for its special use.

Perhaps the outstanding development in spinning is the application of variable speed to the spindles. This permits giving more equal tension to the yarn throughout the spinning cycle. Unequal tension was the result with constant-speed spindles because of the tendency of yarn to become tight where the effective diameter of the bobbins was small, and loose where this diameter was large. Variable speed permits greater production per spindle, as the maximum speed of the spindle is no longer determined by a condition which exists for only a fractional part of the working cycle.

Variable speed has been accomplished generally by the use of variable-speed motors directly connected to the individual frames without clutches.

The automatic loom has been improved by heavier construction and by using antifriction bearings for the main journals. In addition, more attention has been paid to the kinematics of design, resulting in harness motion of smoother acceleration and head motion freer of variation caused by the picker action. The result is a loom which runs with less vibration and consequently at a higher speed than heretofore has been considered practical in the industry.

Out of the electric stop motion now in use has grown complete electrical control of the loom. This is accomplished by equipping the loom with an individual motor of the double squirrel-cage type, which is capable of giving a high starting torque when thrown directly across the line. This permits a push-button control of the motor with resulting facility of starting and stopping the loom from any working position taken by the weaver, which is an obvious advantage.

Marked progress is developing in the direction of grouping finishing machinery in series or ranges. This

was exemplified in a paper presented at the same meeting, by W. S. Brown, of F. P. Sheldon & Son, Providence, R. I., who defined range drives as the successive processing of goods without intermediate handling through separate machines arranged in series, or "intrain," as against the older method of operating individual processes singly. The older methods involve intermediate handling, consisting of packaging, transportation, and storage between machines.

Some of the forms of mechanical range drives are not new, for instance the old rope soaper ranges. Undoubtedly, Mr. Brown explained, new combinations, more frequent combinations, and larger groups of machine are now being put into ranges than formerly, and the practice generally is recognized as good. In part, this is due to, and also has been the cause of refinements in the development of automatic speed-control equipment. The question now is how much equipment to place in range, the number of machines being limited by economics rather than by mechanics.

A range drive includes two or more separately driven units or machines. These separate drives are arranged with inter-control so designed as to insure the proper degree of synchronism under

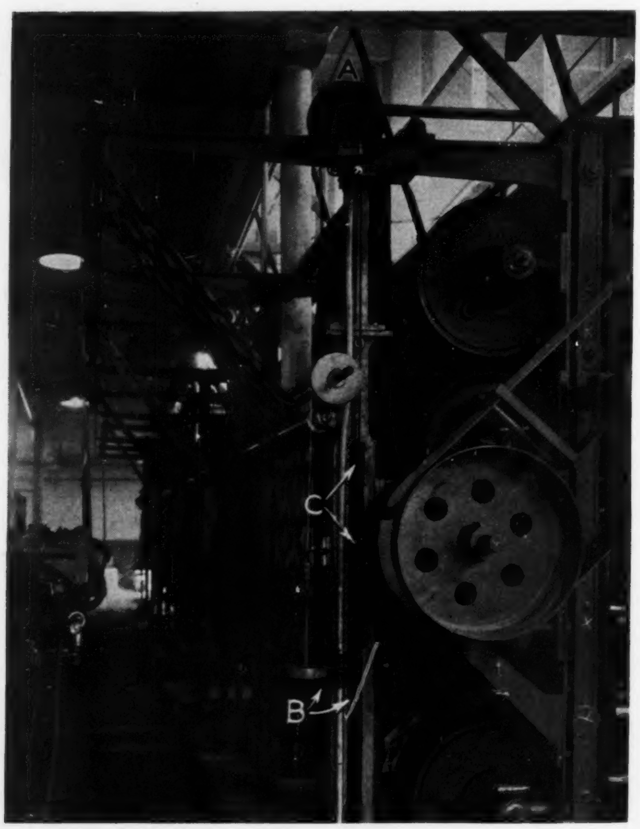


Fig. 1—Installation of dancer roll on finishing range, showing: A, dancer rheostat; B, dancer roll; C, slot in which dancer roll travels

changing over-all speeds and other varying conditions. Range drives may be divided into three classes according to the method adopted for driving the individual units or groups.

Class 1, Adjustable Speed Motors

These are synchronized by rheostatic control for direct-current motors, and usually by brushshifting elements for alternating-current motors. Synchronizing in some instances is accomplished manually, but usually is most satisfactorily performed by automatic actuation through a "dancer roll" or other mechanism.

A dancer roll, as shown in Fig. 1, consists of an idler roll floating upon a fold of cloth as the latter passes from one machine to another. The vertical movement of this roll is dependent upon the variation in accumulated slackness of the cloth, and is communicated to and operates on the motor control device. This type of control can be made sufficiently sensitive to act over short distances of roll travel, especially if the control device is of the vernier type, superimposed upon a main regulating device which controls the range as a whole.

Direct current adjustable speed ranges are of two types: (*A*) Constant voltage, using specially designed but now standard motors, with field and armature control, and (*B*) multi-voltage, including the Ward Leonard with standard motors. The former or direct current variable speed equipment of the constant voltage type is highly developed and thoroughly reliable. A typical example of this system of range-control equipment follows:

(1) Control from one central push-button station providing the function of "Inching," "Run" (fast or slow), and "Stop."

(2) Predetermined speed setting, without necessity of adjusting main rheostat each time, when starting.

(3) Automatic time or current-limit acceleration.

(4) Dynamic breaking for quick stopping electrically.

(5) Interlocked field rheostats for full-field starting.

(6) Emergency "Stop" and "Lock-safe" push buttons located where required.

A further recent and comparatively expensive development for automatic control without the use of dancer rolls is known as the differential regulatory or rotary field rheostat. This has been used in paper mill ranges and for pile fabric

which latter would be damaged by dancer rolls. It consists of a continuously adjustable rotary field rheostat driven by a synchronous motor, and mechanically operated by the differential movement of a screw and nut, both of which operate continuously in the same direction, the nut forming a part of the rheostat cylinder, and the screw being driven directly from the section motor.

Class 2, Constant-Speed Shafts

With machines or groups driven from constant speed sources, it makes no difference whether these sources are mechanically driven or motor driven shafts. In either event, the individual groups may be synchronized by means of mechanical speed changers based on various principles, including the use of such well-known devices as expanding pulleys, cone pulleys, variators, and more recently the fluid motor known otherwise as the "oil gear" or "hydraulic variable speed transmission."

At the present time the mechanical variator is quite extensively used for converting constant speed to adjustable speed. It operates on the principle of varying pulley diameters, and was first developed for manual control only. It is a competitive device, now highly developed, and used in range drives for the automatic synchronization of various groups. This is accomplished usually through the familiar medium of a dancer roll which operates on the variator directly and mechanically, or which, instead, may actuate the variator through a reversible pilot motor.

Class 3, Adjustable Speed Steam Engines

Small adjustable speed steam engines in range seem to be infrequently used on account, no doubt, of trouble from oil, dirt, etc. Speed control and synchronizing may be accomplished, however, by manual or automatic control of steam supply through the medium of a dancer roll, as for other types of adjustable speed equipment.

The successful operation of finishing machinery in range is dependent upon the attainment of various advantages, and the relative importance of these items varies widely, according to special operating conditions at different plants and the goods being processed. Each case must be analyzed carefully, and the various factors given their proper weight in the total perspective. Often it is possible to utilize much present plant equipment in re-organized range drives, with little additional machinery.

Some possible advantages of range drives are:

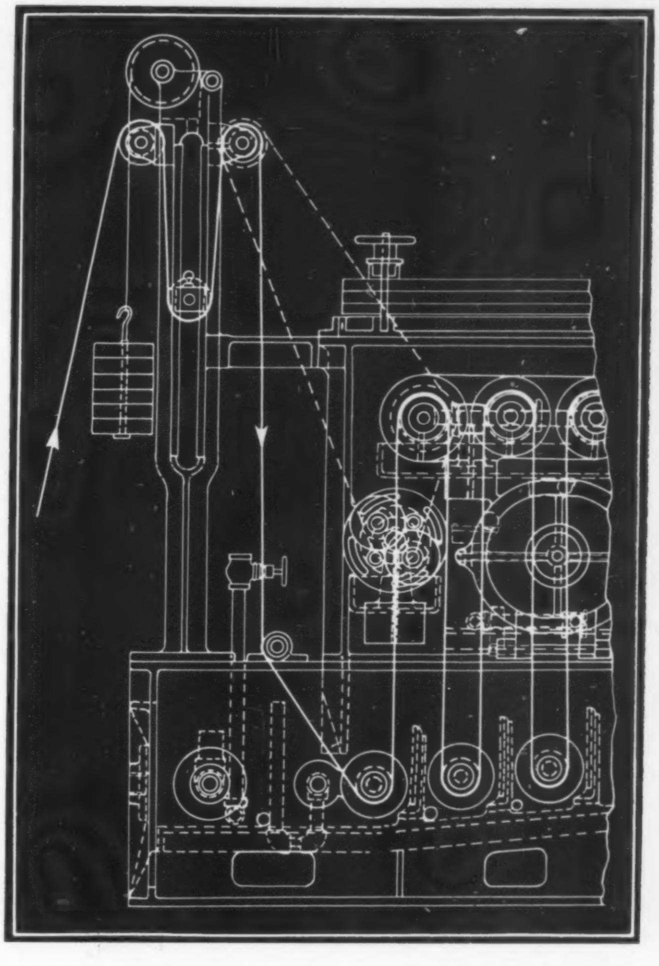


Fig. 2—Drawing of dancer roll mechanism, in mercerizing process, showing balance weights

(1) Reduction in or elimination of several "in-between" losses.

(2) Improved uniformity and quality of product.

(3) Saving in power and maintenance expense.

(4) Saving in executive and office work.

(5) Increased production.

There are also inherent disadvantages in range drives which must be overcome as far as possible in order to obtain maximum economy. These, too, vary in number and importance, and should be the subject of thorough investigation for each individual case. Some of the disadvantages are:

(1) The present market tendency toward a multiplicity of small lots and varied styles, and the demand for samples.

(2) Range speeds are limited to that of the slowest member.

(3) Breakdowns tie up production.

(4) Additional building construction may be necessary.

(5) Operating losses due to cloth damage.

(6) Somewhat greater initial machine expense.

Organization and Supervision of Design Department

By John F. Hardecker

Part V

Duties of Patent Section—Numbering Machines, Drawings and Parts—Clerical Work—Delay Reports—Information Requests

VITAL to the successful functioning of an engineering department is a competent patent section. It can render numerous services, apart from thorough protection of new designs, along the lines of research, patent recommendations and in a consulting capacity. Mr. Hardecker, in the accompanying article, discusses fully the value of such a section and its economical operation. Numbering systems for machines, etc., also are dealt with.

IN NO phase of modern industrialism can there be found greater justification of the age old adage that "foresight is better than hindsight," than in the matter of patents. Evolved as an aid and a bulwark of strength to inventive endeavor, the patent may often prove a boomerang, and become the means of destroying the structure it has been designed to build up. With full confidence in the strength of his patent, a manufacturer may well be tempted to put all his eggs in one basket, only to find that a single weak clause, ambiguous phrase, or improperly detailed drawing, may be the means of destroying his entire basket with one single legal blow.

This may sound like a gloomy dirge anent patents, but too many seemingly prosperous and well-equipped ships of industry have come to grief on the hidden rocks of patent litigation, not to sound a warning in advance. Far too much research effort has been expended trying to develop a patentable invention that already exists in another industry, far too many concerns have strayed in their development from their original patent only to find that their very security has led them astray into infringements on other patents, not to warrant a note of caution. The sense of security implied by a patent may cause a concern to handle the details so secretly that the patent itself may be declared invalid for lack of such clear disclosure that the public may at the expiration of the patent have a full and workable use of the invention.

Expert Presentation Is Essential

As in all matters based on legal procedure, it is not so much a matter of inherent strength or value in the patented idea, as it is a matter of how well the case is presented. Patent law and procedure are not simple details to be handled by the layman. The future value of a patent may be entirely dependent on how well the basic claims are presented, which is a mat-

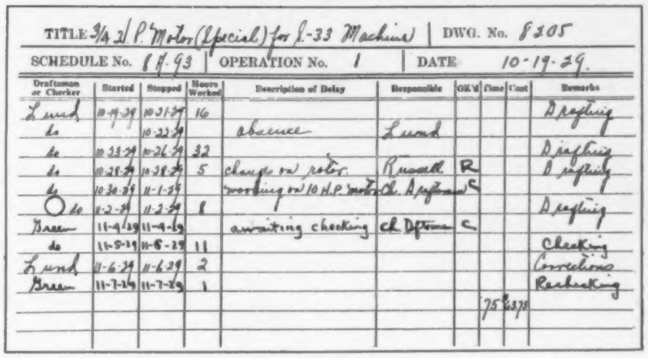
ter for consideration and ingenious handling.

It is incumbent, therefore, upon any concern the success of which is dependent upon patents, or which contemplates engaging in work where patents are essential for protection, to organize a patent section in their engineering department. This is an investment which will tend to decrease production costs and stifle competition. If the organization is not large enough to warrant such a specialized section, it should arrange for a consulting patent counsel. This should be on a regular retainer basis, as the patent counsel should be familiar, through extended association, with the particular business in order to render the maximum of valuable service.

The patent section is assuming an increasing importance in machine design activity. It renders not only the detail service incidental to preparing proper drawings and presenting strong claims, but it also renders a frequently greater and more important service when the job is in its preliminary stages on the drafting board. It does this through its searches of patent files, to discover exactly what previously has been done along the proposed line. There is no point in blazing out a new trail when a good road already lies parallel just over the hill. Today, much of progress in any machine industry lies in adapting and adopting the pioneering developments of what have hitherto been regarded as unrelated industries. It has not been unknown for a manufacturer to spend tens of thousands of dollars on a research development, only to find that he has arrived at a solution essentially the same as one patented years previously in another industry. Such incidents it is the function of the patent section to prevent.

Profitable Investment Can Be Assured

The costs of patent sections and patent activities can be kept down to the point where they represent a profitable investment, by making proper and full use of the specialized knowledge centered therein. On every new engineering development, whether in product, material or process, they should be consulted at its inception. Their consulting engineering service should not so much take the lines of that of a design consultant, although their experience may at times well qualify them for this, but rather it should be as a check and a source of information as to what already has been accomplished and made available along similar lines. In addition to their knowledge of patent law and procedure, they can also render a signal service in recommendations as to what phase of a new development is best patented—whether the product itself, the process machinery, the material composition or the design form.



TITLE 3/4 H.P. Motor (Special) for S-33 Machine | DWG. No. 8205

SCHEDULE No. 8-93 | OPERATION No. 1 | DATE 10-19-29.

Draftsman or Checker	Started	Stopped	Hours Worked	Description of Delay	Responsible	OK'd	Time	Cost	Remarks
Lund	10-19-29	10-21-29	16						Drafting
do		10-22-29		absence	Lund				
do	10-23-29	10-26-29	32						Drafting
do	10-28-29	10-28-29	5	change on rotor	Russell	R			Drafting
do	10-30-29	11-1-29		working on 10 H.P. motor	Ch. Draftsman	C			
do	11-2-29	11-2-29	8						Drafting
Green	11-4-29	11-4-29		awaiting checking	Ch. Draftsman	C			
do	11-5-29	11-5-29	11						Checking
Lund	11-6-29	11-6-29	2						Corrections
Green	11-7-29	11-7-29	1						Rechecking
							75	$375	

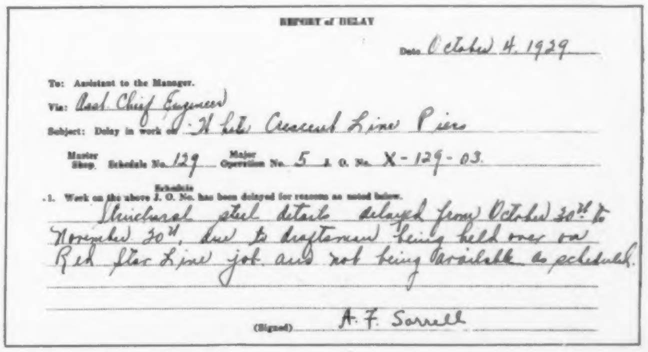
Fig. 1—Type of job card for recording draftsmen's time on individual drawings

The fostering of invention is contingent to a great extent upon the incentive offered designers. That there should be some form of this seems to be an agreed precept, but due to the many ramifications of the problem, no generalized solution can be offered in a necessarily brief discussion. To a great extent this should be dependent upon whether the patent resulted from work specifically assigned the inventor as a part of his regular duty, whether it resulted indirectly from this employment, or whether it lay in some field entirely foreign to his regular duties.

Employer Is Entitled to Protection

As the inventor appears entitled to some reasonable reward for his patent, so too, the employer appears entitled to some form of protection in the relationship. An employment contract with regard to inventions is as desirable as fire insurance. In order to make signatures most readily obtainable without dissent, every employe, from office boy to president should be a signator. While many of the people so signing would be unlikely to be inventors, there is a certain democracy in including everyone.

The systems used for numbering machines,



REPORT of DELAY

Date October 4, 1929

To: Assistant to the Manager.

Via: Asst. Chief Engineer

Subject: Delay in work on [illegible] Crescent Line Piers

Master Shop Schedule No. 129 Major Operation No. 5 J. O. No. X-129-03.

1. Work on the above Schedule J. O. No. has been delayed for reasons as noted below.

Structural steel details delayed from October 30th to November 30th, due to draftsmen being held over on Red Star Line job and not being available as scheduled.

(Signed) A. F. Sorrell

Fig. 2—Form used for reporting delays and specifying revised schedule dates

drawings, patterns and parts used in industry are legion. Many of these are complex, and while based on logical premises at the time of their installation, when they appear feasible and informative, they soon lose their original significance and become merely traditional due to the ramifications of design and the introduction of entirely unrelated products into the output of the organization. The extreme flexibility desirable in modern industry, due to constantly changing products, can only be attained by a system that is extreme simplicity itself. There

Nº 3101

REQUEST
FOR
ENGINEERING INFORMATION

Date 10/28/29

Project "Greenbird" Landing Gear Foreman Sanders

Job Order No. 53-29-78AE

Schedule No. 53-29

Name Axle Fitting Part No. LS7205 R&L

Defects Is it permissable to weld casting at wire pull and maintain dimensions—also to remove top lug?

Inspector [illegible]

Project Engineer's Instructions.
Removal of the lug which formerly was used for attachment of the jury strut to which the axle hooks were attached, is allowed.
Welding added material at the rear strut attachment lug, where such material was ground away in error by the foundry, is permitted in this schedule only.
[illegible]

Fig. 3—Engineering information request form used by inspection department

is no one system that is best for all uses, and in the discussion that follows, the object is not to offer a universal solution, but to point out the underlying principles and desirable features of a proper system.

Should Carry Model and Serial Number

The machine itself should bear a model and a serial number. Where the model types are few, this model number readily may become a name, otherwise it may be any reasonable combination of numbers and letters. Relationship between the particular model in question with preceding and future models of similar character may be indicated by using names beginning or ending with the same letter in a given series of models, or by a number or letter in a certain position in the model number. The model number also may be expanded to indicate by the position of numbers or letters, whether the machine has been modified or has certain attachments with it that will permit its application to certain special purposes, or that it has been modified to comply with local conditions in certain countries. The serial number is highly desirable for identification purposes, and particularly with respect to replacement parts where the machine is constantly undergoing minor improvements, so that the exact status of any machine in the field readily may be known. This, of course, assumes the proper keeping of records as to which serial number of machine changes become effective on.

Care Essential in Numbering Drawings

While for numbering drawings there have been many elaborate schemes evolved for keying the number, so that the represented part and its location and function in the machine might be recognized solely by its drawing number, such schemes invariably have destroyed themselves due to the changes in fundamental design practice and the introduction of unrelated products into the organization's output. Where such schemes have survived through sheer inertia, the time lost in debates as to the proper allocation of numbers to certain parts, would have caused the original proponents of the scheme to question its proposal if they could have anticipated the resultant situation in all its aspects.

For general all around utility, a straight serial numbering system for drawings usually is best. Where standard sizes of drawing sheets have been adopted in accordance with the filing equipment available, it is permissible to key in the size of sheet with the first figure in a drawing serial number. Thus the number of the smallest size sheet would always begin with a 1, followed by the serial number, the next size sheet would begin with a 2, etc. Purely experimental sketch drawings may at times be advantageously numbered with an identifying number, such as O, preceding the regular number, to indicate their character. In certain industries, a manufacturer may find it highly desirable to introduce an identifying letter into his serial number, so that the drawing numbers generally may be identified as his, particularly when customers, jobbers, etc., refer only to number in their correspondence.

Basic Drawing Number for Each Sheet

Assuming the fundamental drawing numbering scheme to be established, there are a few rules the observation of which will aid greatly in their utility after application . Any given size drawing sheet should bear only one basic drawing number. All parts detailed on that sheet should be dash numbers of the drawing number, which automatically become the part numbers of the pieces. Parts used in more than one assembly, are best detailed independently on smaller size

sheets, so that it is not necessary to issue a large assembly drawing to the shop for the manufacture of a single dash-numbered piece shown on it. Once assigned a part number, a given piece should always be referred to by that number, and never redetailed under another number. Simple and obvious as this may seem, duplication of this kind has been only too frequent.

On tabulated drawings, which are generally standards subject to frequent use, it is often possible to key the dash number with the variable. For example, on a drawing of a given size bolt varying in length by increments of an eighth inch, the dash number may correspond to the length in eighths of an inch, i. e. dash 12 is one inch long, dash 17 one and five-eighths inches long, etc. While in some instances there may be advantages in reserving blocks of drawing numbers for specific purposes, it is generally advisable to use them serially as requested regardless of the job they are required for. Numbers are cheap, and a great deal of future trouble can be avoided by the simple rule of never permitting their re-use under any circumstances. Where drawings are issued in sets, they are best bound serially, and in no case should more than one drawing appear on a single blue printed sheet.

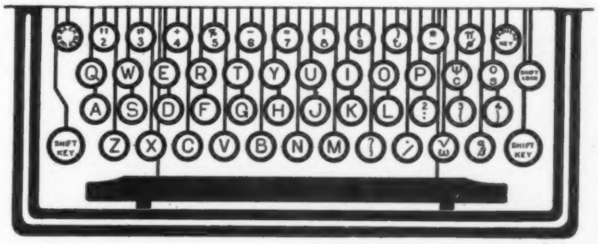


Fig. 4—Special keyboard for typewriter used in engineering department. Note the keys for mathematical symbols

Same Detail Used in Different Places

Templates are usually best identified by their part number. Patterns, dies, etc. also may be so identified, but in this case there may be advantages to a separate numbering scheme, inasmuch as the same die or pattern may be used for several different related parts, differing only in modifications made after the initial operation. In such instances, the numbering scheme should be such as to avoid all possible confusion with the part numbering system, and of such a character as to group all similar dies, patterns, etc. together for reference purposes, and to avoid the manufacture of new ones where suitable ones already exist. In such cases, it is also highly desirable to tie in the pattern or die number by reference on the part drawing itself.

The multiplicity of numbering schemes is in itself not necessarily a hardship, as in an organization manufacturing to many outside firm's drawings, the very character of the number may serve as its identification. In general though, where foreign drawings are used directly for manufacturing, it is best to make the firm's name or an abbreviation of it a part of the drawing number in all manufacturing orders, correspondence, etc., to avoid possible error.

Using Stenographical Help Efficiently

Entirely apart from the proper keeping of drawing records, there is a certain amount of clerical and stenographic work in a design division. While true organization, as a whole, may use a central stenographic section, it is best to have a special stenographer, or group of stenographers for design department work, due to the highly technical nature of the correspondence and the need for extreme accuracy. It may be advantageous to have a long carriage typewriter in the department for special charts, reports, etc., as well as a special typewriter with the mathematical characters customarily used in the industry added to its special keyboard as indicated in Fig. 4. While for purposes of handling visitors, answering phone calls, etc., it may be advisable to locate these stenographers at strategical points in the design department, they should in no sense function as private secretaries exclusively, but should be available for assignment of work by the head of the clerical record section. In this way a proper balance of work can be maintained through distribution, whereas otherwise certain stenographers would be overloaded while others would have comparatively little to do at times.

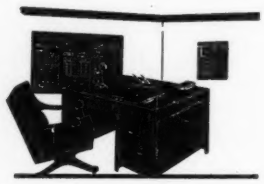
In addition to the work of the schedule clerk in making schedules, following up orders, etc., referred to in a previous article of this series, there are certain other functions concerned with the operation of the design department in which the schedule clerk would function. All division personnel whose time is not charged to general supervisory or other general duties, should prepare daily time cards, usually in a manner similar to that prevalent in the shops, using the same form if possible. In addition to giving the model and name of the drawing they are working on, these cards should bear a general designation identifiable in terms of the schedule chart.

Schedule Cards Are Recorded

The schedule clerk then checks off corresponding day and job on the schedule chart as these cards are turned in, using a black check for the drafting time and a red check for checking

time. An "a" indicates absence of the man, and a blank space that he has been temporarily assigned to another job. Proper observation of these records will show the progress of a job, and whether it is destined ultimately to fall behind completion dates well in advance of that possible occurance. After entries have been made the schedule clerk forwards the time cards to the accounting department.

In certain large organizations handling a multiplicity of work, it may be deemed advisable to keep even a closer check on the individual draftsmen. In such cases a job card, as shown in Fig. 1, may be preferred for each drawing or layout, and follow the drawing through to issue. While these are prepared and kept up by the drafting personnel, the schedule clerk should be responsible for checking them and seeing that they are properly executed. These job cards bear the title and number of the drawing to which they refer, and one of their functions is to serve as an instruction card for the draftsman, information in designated spaces on the reverse side being the general instructions the draftsman gets from the squad leader. Job cards give information relative to the time spent on drafting, checking, correcting after checking and rechecking. They also indicate the scope of, and the responsibility for all lost time, either holdups or revisions, caused by absence, customer's changes, project engineer's changes, drafting errors, reassignments, etc.



Delay Report Should Be Prepared

If, after due anticipatory notification from the schedule clerk, the chief draftsman cannot rearrange his schedules so as to meet a scheduled completion date for a design, the schedule clerk should prepare at his direction a delay report, similar in form to that shown in Fig. 2. The delay report should quote the original scheduled date as well as the new date established, and great care should be taken that the new date established is one that can be met. Such delays of course are not official until accepted by the general management, which may wish to complete the design in question on time at the expense of some other project. Another useful form in certain types of organizations, with which the schedule clerk is only primarily concerned in following them up and seeing that they are answered promptly, is an engineering information request form as shown in Fig. 3. This is used by the inspection department in procuring engineering information in the shops on parts or sub-assemblies falling under the following headings:—

(a) Parts or sub-assemblies manufactured in accordance with detail drawings or specifications that will not fit on assembly.

(b) Parts or sub-assemblies manufactured in accordance with detail drawings or specifications that are believed to be weak in construction.

(c) Parts or sub-assemblies manufactured in accordance with detail drawings or specifications that will not function in accordance with general specifications.

(d) Discrepancies in drawings and specifications.

(e) Changes in existing process specifications to expedite the manufacture of parts in accordance with practical shop methods.

In case of material falling under the headings (a), (b) and (c) the inspector tags the part with a rejection tag and forwards the engineering information request form. In case (d) he also forwards this form. In cases where the shop superintendent desires a change in process specifications, in order to meet shop practices and to expedite production, he will request the inspector to forward this form. Such requests should be regarded as urgent in the design department and consequently should be acted on accordingly.

Standardization in Drawing Room Practice is Progressing

While no meetings of the American Society of Mechanical Engineers' sectional committee on drawings and drafting room practice were held during the past year, members of subcommittees were active.

The committee which prepared a redraft of the section on means for indicating methods has this literature in the course of preparation for general distribution. Material covering each of the sections on specifications for paper and cloth, lettering, and graphic symbols, is in the hands of the corresponding subcommittees for consideration.

Subcommittee No. 5 on line work is modifying and extending its preliminary report.

A new wall chart published by the Diamond Chain & Mfg. Co., Indianapolis, gives information necessary for the selection of proper chain lengths for any application. Size, weight, tensile strength, speed, rated horsepowers and loads in pounds are given, with corresponding information on sprockets to fit various sizes of chain.

Developments in Machine Parts Are Reflected at Exposition

MANY members of the design profession attended the eighth annual exposition of power and mechanical engineering at Grand Central palace, New York, Dec. 2-7, and nearly every state and foreign country was represented among the exhibitors as well as among the visitors. Prominent universities took advantage of the exhibit as an educational feature and representative groups from nearly 50 universities and technical schools attended.

Study of the numerous booths in which transmission equipment and machine parts were displayed revealed many interesting features. With the advent of direct-connected motors it might be thought that interest would lag to some extent in such items as belts and speed reducers. That such is not the case, however, was borne out by the number of visitors to these booths.

Exhibitors who were able to demonstrate their products under operating conditions were called on to handle a continuous flow of inquiries. Instances of this interest in mechanical movement could be found in large measure at the booths of driving chain manufacturers. Two companies showed by means of clever devices an apparent slowing down of the speed of operation of mounted silent chain drives, thus demonstrating the actual engagement of the chains with the wheel teeth.

Operating Units Attract Attention

An exhibit which attracted considerable attention was a speed reduction unit designed primarily for the textile industry. Action of an oil slinger for lubricating the gears not actually running in the oil bath could be studied through a circular glass cover as well as the property of the slinger in throwing oil away from the lower bearing through which otherwise there would be a tendency for leakage. All gears in the box were of the helical type. Another feature was the circular construction permitting adjustability of the height of the input spindle to line up with the spindles of motors of varying spindle heights. More than a dozen manufacturers of gear reducing units were represented at the show, giving an indication of the importance which attaches to this type of equipment.

Standardized gears were shown, as was a type of gear about which little has been heard in this country before. This is a spiral gear made in the smaller sizes, the teeth of which are finished by a special grinding process.

Numerous Lubrication Systems Shown

Lubrication devices and systems were well represented. One company showed its pneumatic-electric system under running conditions, demonstrating the feed control by which it is possible to furnish lubrication to bearings at intervals of five minutes or 24 hours.

To demonstrate the properties of its fan-cooled motors, a unit of this type was shown running under a glass case in an atmosphere laden with powdered chalk.

As indicating the trend toward increased use of line-start motors, the electrical equipment manufacturers featured across-the-line automatic starters among their line of control apparatus. One company also demonstrated a relay so sensitive that the electrical energy radiating from a human hand would start three motor-driven propellers in a small airplane suspended from a beam in the booth.

Designers who were especially interested in automatic stokers, pumps, water softeners, pulverizing units, ash removal systems, found much of interest in the developments displayed in the booths of manufacturers of this equipment.

Shock Absorber Strut Embodies New Ideas in Design

NUMEROUS contributions have been made by the airplane industry to contemporary design in related fields of endeavor. In fact, many of the materials and principles evolved in aeronautical development have found their counterpart in other industries, often far removed from the field of aeronautics. In the new Edgewater shock absorber strut there is to be found not only an eminently satisfactory solution of a fundamental aeronautical design problem, but the employment of a principle that is of interest to all designers.

The oleo type of landing gear, which depends on the flow of oil past a small orifice for shock absorbing effect, long has been the most satisfactory principle for meeting the landing problems o heavier-than-air craft. The unsolved problem in the past has been to get proper spring action for taxiing, combined with effective oleo cushioning for landing, without too great bulk and weight. After years of experimentation with various types of oleo-gears the report of the U. S. Army Flying Field at Dayton, Ohio, summed up the situation as follows: "Some types of gears have proved to be too complicated, troublesome and costly to maintain, some too heavy and ill adapted to good streamlining, others of the coil spring type were too stiff in action, imposing too much strain and recoil on the fuselage, and still others of late design have the serious fault of failing to return to the "charged" position after the plane has left the ground.

New Strut Has Combined Advantages

In the design of the Edgewater ring spring strut these important factors have been taken into consideration. The strut which is shown in section in Fig. 1, combines all the advantages of the oleo strut with none of the disadvantages of former types of landing gears such as the oleo-pneumatic gear with its complicated design and high maintenance cost, the heavy cumbersome oleo-rubber gear and the oleo coil spring gear with its low spring capacity and high recoil action. The new strut provides not only a smooth, cushioned action to the shocks of landing, but also the proper spring action for taxiing without undue recoil or strain on the fuselage.

The strut is designed to take up part of its travel against oleo and the remainder against the new ring spring, shown in section in Fig. 3, which takes the place of air, rubber or coil

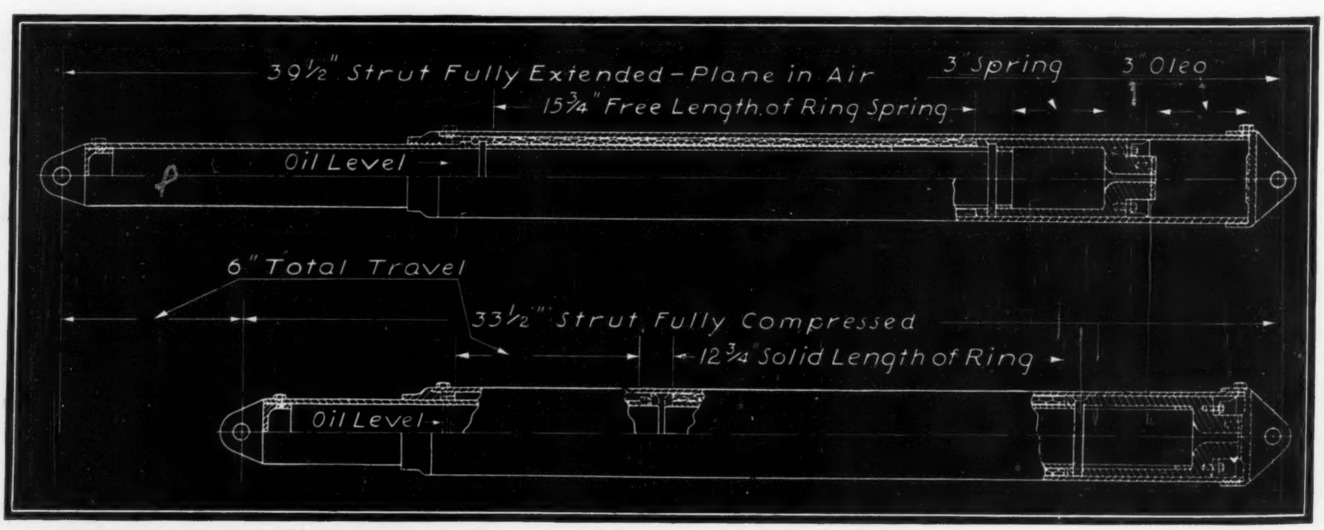


Fig. 1—Airplane shock absorbing strut in extended and compressed positions. Total length of travel is six inches, divided between spring action and oil pressure

springs. This spring consists of a number of outer and inner solid rings, alternately spaced. For a spring having a diameter of 2 inches, the rings are about 3/8-inch wide and have a wall thickness of about 1/8-inch for the outer rings and 1/16-inch for the inner. Each ring is coacting with adjacent ones along conical faces, the outer surfaces of the inner rings and the inner surfaces of the outer rings being beveled in such a way that when the spring is in compression, the inner rings are wedged inside the others. The angle of the bevel is such that when the load is removed, the rings slip into their original positions.

The result is, when pressure is applied to either end of the spring, the rings telescope into each other in such a way that the outer rings expand and the inner rings contract. The following are a few features of the ring spring:

Fig. 3—Sections of inner and outer rings. Under compression the outer rings expand and the inner contract

1. It is one-third the weight of a coiled spring

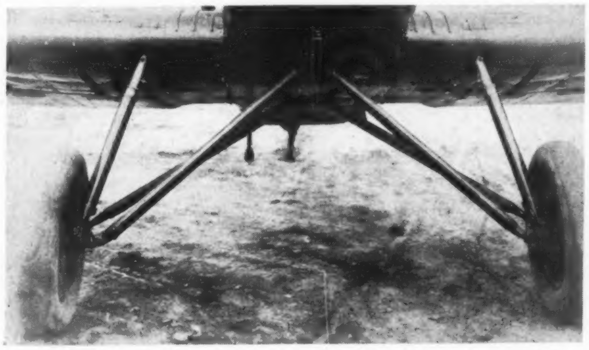


Fig. 2—Ring spring struts installed on a plane

having an equivalent capacity and travel.
2. It dissipates two-thirds of the energy put into it, and therefore, has little recoil.
3. It is very compact.
4. Its deflection equals 20 per cent of its free length.

The initial landing impact of the plane is thoroughly absorbed on a cushion of oleo plus the resistance of the ring spring. The first impact occurring just as the wheels are touching the ground, is taken with the spring interposed between the plane and the oleo. As the plane settles down in taxiing, the spring again comes into action and affords protection to the plane against the irregularities of the flying field, with full travel available with effectively dampened recoil.

Simplicity Characterizes Design of Strut

Design of the strut is simplicity itself, consisting essentially of two telescoping tubes, an orifice and a ring spring. Since there are no packing glands, there is no gland friction to prevent the struts from returning to their fully extended position while the plane is in the air, removing a dangerous landing possibility. Oil leakage is reduced to a minimum due to the fact that the oil never gets above the test plug in the center, which is actually lower than the top of the tube. Briefly the strut is a simple mechanism which does not require any maintenance attention except a check of the oil level at ninety-day intervals.

In conclusion, this strut is of interest to aeronautical designers for the practical worked out solution it presents of a long time major problem. To designers in general it is significant as a whole, because of its new ring spring, and because it illustrates the basic advantage in machine design of utilizing the proven phases of accepted and demonstrated design and adding to it only such new features as are necessary to overcome previously unsurmounted difficulties.

Machine Design Offers Bound Volumes

Those readers and others who wish to obtain complete bound copies of Volume 1 of MACHINE DESIGN should notify the publishes at an early date. Included in the bound volume are the first four issues and a comprehensive index to contents. The volume is tastefully bound in black and red leather, imprinted in gold. A limited supply is available at $6 each plus postage, or $5 if the four issues are furnished by the reader.

The index to this volume, comprising the September, October, November and December, 1929, issues, appears on pages 67 to 70 inclusive, of the present issue. It also is available separately, in the form of a folder, and will be supplied free of charge to subscribers upon request.

PROFESSIONAL VIEWPOINTS

Publication of letters does not necessarily imply that MACHINE DESIGN *supports the views expressea*

Comments from Our Readers. Machine Design Will Pay for Letters Suitable for Publication

Can Design Work Be Scheduled?

To the Editor:

In your October, 1929 issue, there is a discourse on a phase of scheduling dealing directly with designing layout, detailing, checking, etc. We agree with everything in this particular article with the exception of the author's statement that even designing can be done according to a prearranged schedule.

Our engineering department is very large and we are constantly designing new planes and revising existing models, practically all our work dealing with military ships. We therefore have a tremendous amount of experience in designing. Still we find it impossible to schedule designing. Nor do we understand how it can be done.

Designing is creative or inventive work. Every major unit to be designed needs to have a good deal of time spent in thought, study, research, figuring, etc. Then, it must be revamped, washing out the bugs and making improvements as suggested by both theory and shop practice. Finally it is ready for detailing. But the very nature of the work itself eliminates the possibilities of setting a timed schedule as a control.

We would like to hear from other readers, both thoughts and experiences along this line.

In closing, we wish to express our appreciation for your publication. We look forward to each succeeding issue with great interest.

—H. C. GOETZ, JR.,
Santa Monica, Calif.

Should Blueprints Be Furnished?

To the Editor:

How often do we write to machine builders for a blueprint of some particular part on a machine that we have recently purchased from them, and they come back with a reply in which we are advised that they do not allow blueprints of their machines or parts thereof to leave their plant; however, if we would advise them as to just what we are trying to do with this particular machine, they perhaps could be of service.

It then becomes necessary, in order to keep the development of some special tool or mechanism from a competitor, until we at least get it in production, to pull the machine from the production line and send it to the engineering department, where it is dismantled and completely detailed for future reference.

For seventeen years I have been connected with the machinery and tool industry and on several occasions I have seen this emergency arise and culminate in a like manner. There are a number of progressive machine builders who aim to co-operate with the trade and with whom it is a pleasure to associate in business, whereas on the other hand there are a few who, as a result of such tactics as I have illustrated, are laying dormant or are passing.

The real secret in the phenomenal stride of the automotive industries has been co-operative research, design and management. In no case does any one company owe its success to the monopoly of product, through some basic patent, which is the aim of the companies adhering to such procedure as outlined. As a machine designing engineer, I have yet to see the first machine patent that affords a monopoly, the nearest approach to which was the internal combustion engine; this, however, after considerable litigation, went the way of its predecessors.

When a company develops a new machine and wishes to monopolize the market, there is only one possible recourse, and that is, not to sell the machine but to sell the work or the product that the machine produces.

The minute the machine is thrown on the market it is obvious that its construction no longer can be kept a secret, and whether making, using, or selling a particular thing infringes some patent claims, is always a question. Sometimes it can be decided by applying a rule of law, and sometimes only by common sense. Where your patent

covers a machine or method of manufacture, the question of whether or not another machine or manufacture produces the same results is not the thing which determines infringement. The results may be identical, but the means for producing them quite different, consequently, anybody may produce the same result without infringing the patent if he uses substantially different means.

There is no incentive of course to develop a new machine in which a different means is employed to accomplish the same results, when the machine manufacturer co-operates with the trade. But when he refuses to send out blueprints of his machine and it becomes necessary for the purchaser to make a complete set of drawings in order that certain developments may be made from time to time to meet production requirements, he is very apt, in the course of such procedure, to go around the patent and at the same time develop the machine to suit the company's individual requirements. This, in the main, may account for the passing of the companies who fail to co-operate in this respect.

I believe it is only a question of time when the machine and tool builders will be compelled to include with the sale of each machine a complete set of detail and assembly drawings, which some large companies already insist on. I can see only a beneficial effect, to all concerned, by so doing.

The time is not far distant when the manufacturer in the machinery field as well as the automotive industries will catalog their parts in such a way that the designing engineer will be able to incorporate them in his design. Thereby he will create not only a greater consumption for parts, but at the same time incorporate in his design parts machined with the utmost precision and of such material and heat treatment that would otherwise be prohibitive.

—GEORGE T. CHAPMAN,
Detroit.

Lubrication of Antifriction Bearings

To the Editor:

May I comment on the article on antifriction bearings in the October, 1929 issue?

The companies with which I have been associated always recommend grease for the lubrication of antifriction bearings, except for high speeds or extremely high temperatures. Grease requires renewal only at long intervals, is clean, forms a seal against dirt or moisture and coats the bearing against rust. It can be obtained as normal grease, high speed or high temperature.

Oil, on the other hand, gives better lubrication on very high speeds, but it is more likely to sling out of the housing, which requires more expensive protection and means more replenishing of the oil; it does not form a seal for protection and when the machine is stopped it runs off the bearing so that rust may form.

I believe the author's remarks in the last paragraph are too general, even for a brief article. One of the most frequent causes of breakdown of balls or tracks is severe end-thrust due to mismounting or other reasons. Another cause is fitting the revolving race too tightly on the shaft, which in many instances leads to trouble due to excessive expansion of the inner (revolving) race. In one case we investigated, this shaft was .0015-inch over normal size for tight fit. This expanded the inner race causing binding between balls and tracks, and breakdown due to initial overload.

If a bearing is lapped, it may be due to dirt, rust through action of moisture or fumes, or other causes. Lack of, or faulty, lubrication will allow the cage to wear, and the particles will lap the tracks.

—J. S. PIERSON,
Kingston, Ont.

Style Pays In Design of Machines

To the Editor:

The subject of the article in the December issue of *Machine Design*, "Style in Design" is one in which the writer has always been interested. Not only must the question of style be taken into consideration, as developments in the product progress from time to time, but the designing engineer must always endeavor to maintain a style which will identify his own firm's product.

The advertising and sales value which style in design has, is just as important on a piece of machinery as on an automobile. A firm whose product is not only pleasing to the eye but is easily recognized as being of their manufacture has a distinct advantage.

It is my opinion when designing a line of machinery or adding to a line that they should be of the same general appearance. It is often necessary that there be mechanical differences in machines of various sizes but so long as their general principle is the same a similarity in style can easily be maintained.

—L. R. TUFTS,
Cleveland.

Creation Versus Demand

Editorial

THOMAS A. EDISON has been quoted to the effect that automatic machinery will play an important role in the future. According to M. K. Wisehart, writing in *Modern Mechanics*, the wizard of Menlo Park believes that the principle of the Jacquard loom —by which the various parts of a machine are brought into action in accordance with a perforated pattern traced on a steel card or paper roll—is the "great reserve principle of the future." He also quotes Mr. Edison as follows: "The full automatic machines now in use give us an indication of some of the savings that we may expect. These machines are making screws and all kinds of small parts. They require very little attention, if any at all, one man being sufficient to attend to a dozen of them." Following additional discussion of the advantages of this type of machine, Mr. Edison asks, "Why should we not have a . . . school of automatic machine designers?" and adds, "Our delay in adopting full automatic machinery is due to a lack of men who can design it."

ENGINEERS will agree wholeheartedly with Mr. Edison on every point except the last. They will support him in his enthusiasm for automatic machines. Likewise they will concur in his opinion that the perforated roll method of controlling machine action, as already employed successfully in piano players and monotype machines, is susceptible to broad application in the future. But when America's leading inventor attributes the delay in the adoption of automatic machinery to the lack of men capable of designing it, he issues a challenge to the design profession that calls for discussion, rather than agreement.

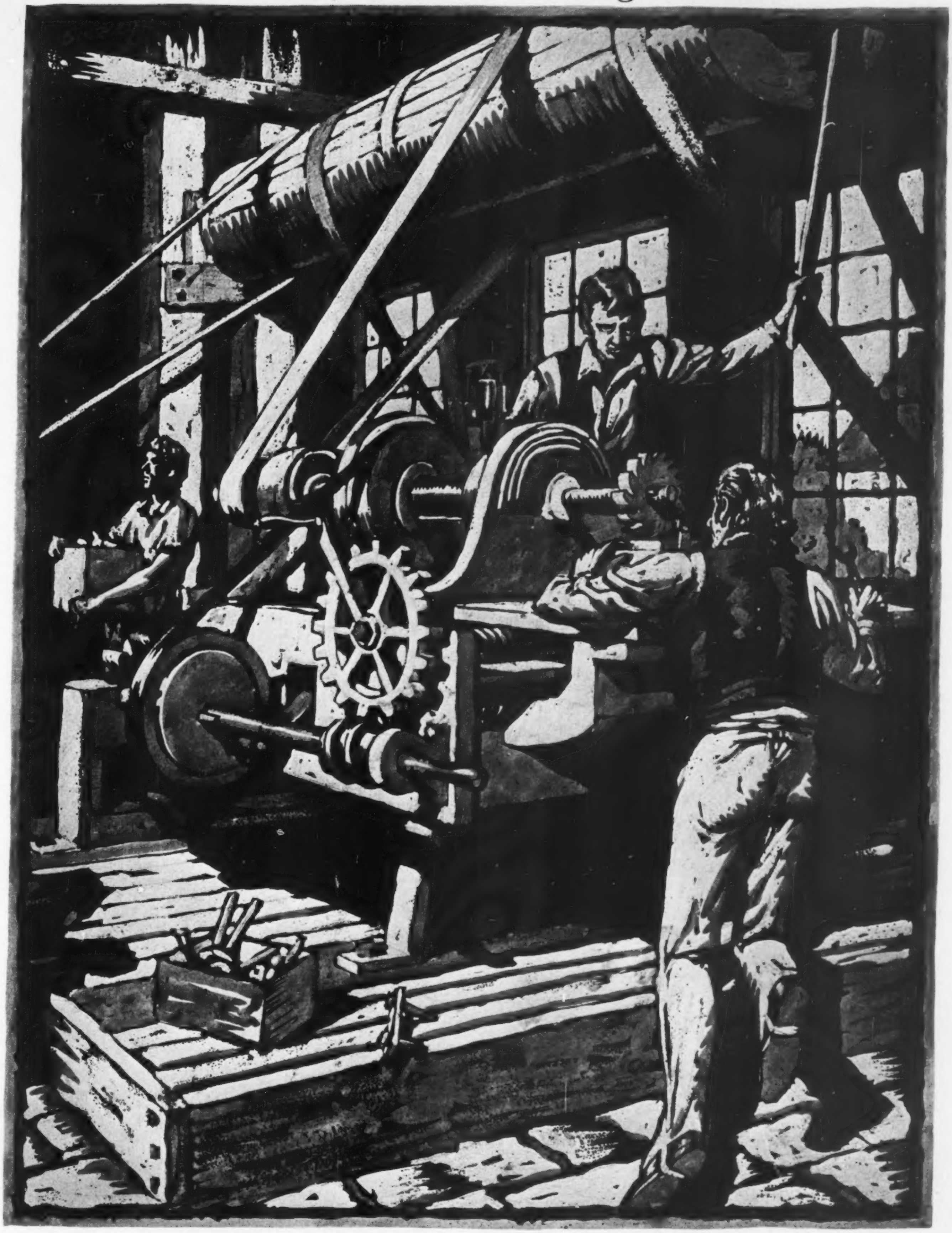
THE introduction of a new machine today involves far more than willingness or ability to design it. As a matter of fact, perhaps hundreds of marvelous machines—some of them automatics—have been designed on paper, and await only the sanction of management to be built. In a few instances, the delay in construction may be charged to the failure of executives to see a demand for these machines, although that demand actually exists. In the majority of cases, however, the dusty blueprints are waiting for the time when the potential users of the proposed machines will be ready—mentally and from an economic standpoint—to receive the new equipment.

EDISON is a practical inventor. Most of his inventions have found a market waiting for them. It may be that somewhere in industry there are companies that would purchase and install full automatic machines to do certain work if the machines were available. However, we believe that as a general proposition, the situation is reversed, and that the ability to design automatic equipment is more than keeping pace with the capacity of industry to absorb it.

Minimizing Machine Noises

IN THE past, designers have been offered few incentives to encourage them to attempt to minimize noise in the operation of machinery. Recently, however, there has been a tendency to place more emphasis on this factor. The American housewife wants quiet running sewing machines and refrigerators, and in some specific cases in industry, noise is being viewed as a liability. The designer's response to this challenge is seen in experimental work with non-resonant gears, in improved cam design and in other refinements. Thus far the limited attention given to the problem of noise has yielded such encouraging results that it is probable more intensive study will be devoted to it. Engineers will do well to look to the possibilities of noise elimination in their work of the future.

Eli Whitney and His Milling Machine



Great Moments in Machine Design—Fifth of a series of original drawings prepared exclusively for this magazine symbolizing the designer's contributions to the progress of mankind.

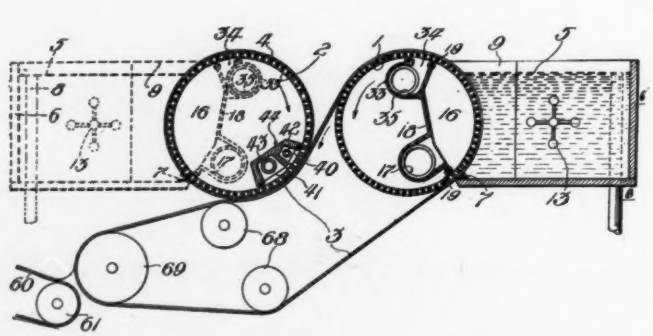
NOTEWORTHY PATENTS

A Monthly Digest of Recently Patented Machines, Parts and Materials Pertaining To Design

PATENTS granted recently include a paper making method and machine invented by William H. Millspaugh, Sandusky, O. The inventor has assigned his patent, which is No. 1,739,038, to the Paper & Textile Machinery Co., Sandusky, O. The accompanying illustration shows a section of the forming cylinders and related parts of the machine, certain parts associated with one of said cylinders being indicated by dotted lines to denote an optional non-use of such parts.

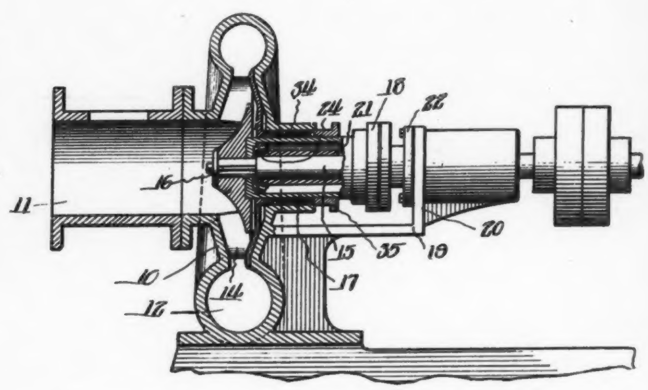
Comprising the machine are two oppositely rotating cylinders, 1 and 2, either or both of which may be used for forming a wet sheet of paper. When both are simultaneously used the wet sheets formed are merged into a unitary thicker sheet. The two cylinders are adapted to maintain vacuum action on portions of their cylindrical surfaces, and are closely perforated or reticulated metal shells, covered by material suitable for a sheet-forming surface. Such a forming surface is continuously supplied around a portion of the cylinder 1 by an endless traveling wire-cloth 3, while the cylinder 2 is similarly surfaced by a wire-cloth jacket 4.

Cylinder 2 in addition to a forming cylinder, serves as a blower roll for forcing steam, compressed air or the like through or into the sheet, whether made on either cylinder alone or by the merging of sheets simultaneously formed on both cylinders. In the case of cylinder 1, a body of liquid pulp 5 bears on a segment of the cylindrical forming surface provided by the wire-covered portion of the cylinder.



Section of paper-making machine showing rotating cylinders on which wet sheets are formed by vacuum-induced collection of pulp fibers

A vacuum chamber 16, communicating by pipes 17 with suitable apparatus capable of maintaining a high vacuum in said chamber while drawing off large volumes of water, is provided. Vacuum action on the cylindrical forming surface in contact with the liquid stock, is thereby maintained.



Sectional elevation of centrifugal pump adapted to handle liquids containing abrasive materials

Patent No. 1,736,426 for an impeller bearing adapted to centrifugal pumps has been issued to Joseph E. Bond, Appleton, Wis., and assigned to Hayton Pump & Blower Co., Appleton. The object of the invention is to provide a bearing element for the impeller, completely isolated from the liquid that is handled by the pump.

By this means, the inventor declares, the pump is adapted to handle liquids containing sand or other fine particles of abrasive material without interruption on account of bearing trouble. Sectional views of the parts in detail are shown in the accompanying illustrations of a centrifugal pump having an impeller 13, with the usual vanes, rigidly mounted on a shaft 15 by means of a key 16. Also fixed to the impeller 13, is a sleeve 17 having marginal flanges 18.

A bearing assembly comprises an inner bearing ring 28, secured by threads to the cylindrical member 21, the rollers 30, and an outer bearing ring 29, firmly fixed in an enlargement of the

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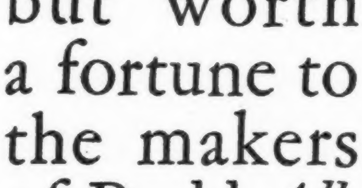

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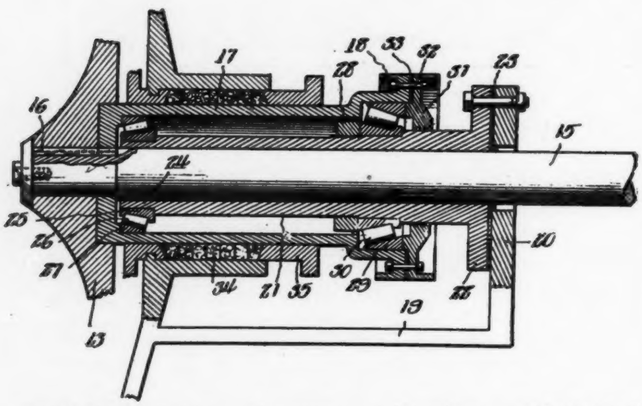
PATENTED APR. 1, 1919 — No. 1299232 — MAR. 28, 1922 — No. 1411184
AUG. 14, 1923 — No. 1465148 — FEB. 10, 1925 — No. 1526182 — OTHERS PENDING

axial opening in sleeve 17. The otherwise open end of the sleeve is closed by means of a circular flange element 31, held against the flange 18 of the sleeve by bolts 32 and bearing against the outer bearing ring 29. Packing 34 is interposed between the pump housing and the rotating sleeve, the packing being held by split glands 35.

Improvement in lubricant-expelling cups is the aim of the invention of Perley H. Fuller, Auburn, Maine, for which he was recently granted patent No. 1,737,838. It has been assigned to Alemite Corp., Chicago. Relation of the parts when the cup is filled with lubricant is shown in Fig. 1. In Fig. 2 their relation is shown when the cup is nearly empty.

A slide valve 8 fits into the large bore 7. Stop 9 is threaded into the large portion of the bore and a spring 10 is located in the smaller portion of the bore. The spring 10 bears against one end of the slide valve 8 and is held in the small portion of the bore by plug 11. The slide valve has

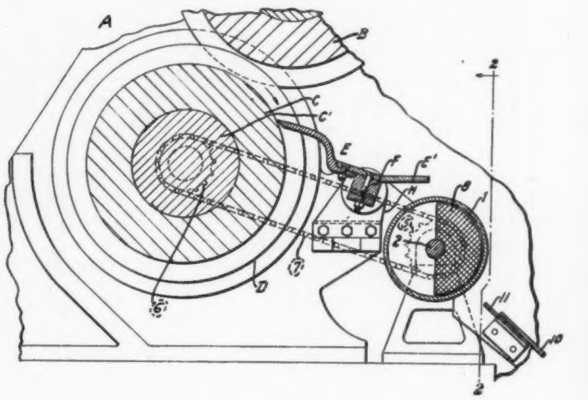


Sectional view of pump showing cylindrical sleeve fixed to impeller, and protection of anti-friction bearings from injurious liquids

an annular groove 12 for communication with the opening 13 above the valve and the discharge passage 14 located above the valve. A port 15 between the large portion of the bore 7 and the reservoir 1 is provided. A vent 16 opens the smaller portion of the bore to the atmosphere.

When the reservoir is full of lubricant, the spring 6 exerts greater pressure on the piston 4 than it does when the reservoir is empty, and between these two points the pressure exerted by the spring gradually decreases. Therefore, if the slide valve means were omitted, a gradually decreasing flow of lubricant would pass through the passage 14 to the parts to be lubricated. However, the groove 12 of the slide valve co-operates with the passages 13 and 14 to automatically increase the cross sectional area through which the lubricant passes as the pressure on the lubricant decreases.

A magnetic separator for cane crushing machinery, invented by Louis J. Struebig, St. Louis, is the feature of patent No. 1,738,739, granted in December. Fulton Iron Works Co., St. Louis, has been assigned the patent by Mr. Struebig.



Cane-crushing machine equipped with magnetic separator to extract metallic foreign matter from cane or bagasse

Magnetic means are provided to extract pieces of metal which find their way into the cane or bagasse, and thus prevent serious damage to the crusher rolls which press the juice from the cane. As shown in the accompanying illustration, a stationary magnetic core 8 is positioned within the shell 1 and secured to the shell 2. Magnetism supplied by common means, passes from the core 8 to shell 1.

Because of the corrugated or ribbed nature of the rolls B and C of the crusher, any piece of metal in the mat of cane will be forced to the bottom of the mat. The magnetic device operat-

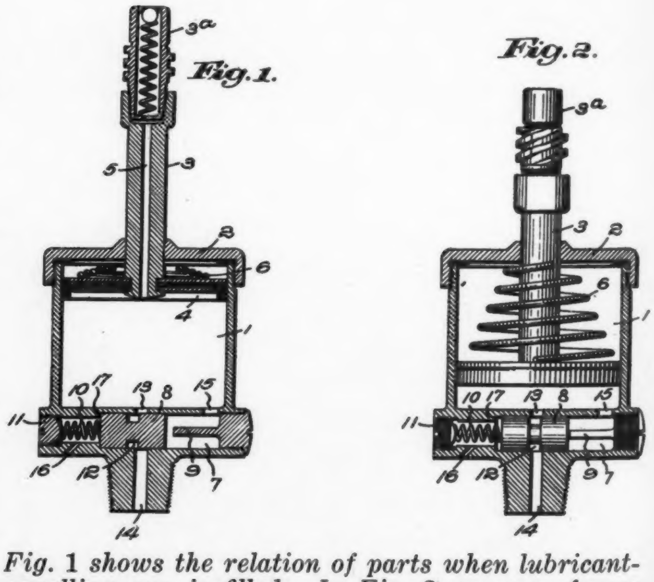


Fig. 1 *shows the relation of parts when lubricant-expelling cup is filled. In Fig.* 2, *presure forces the lubricant through orifice* 15 *and acts on slide valve to move it toward the stop at* 17

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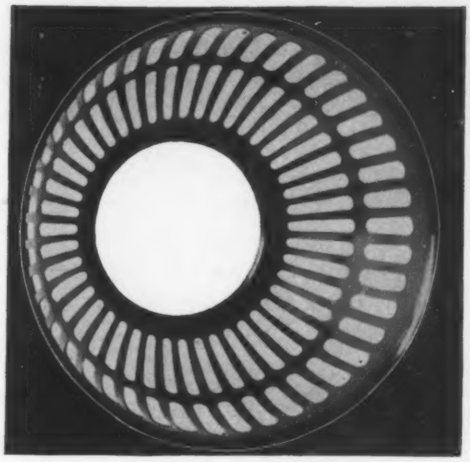

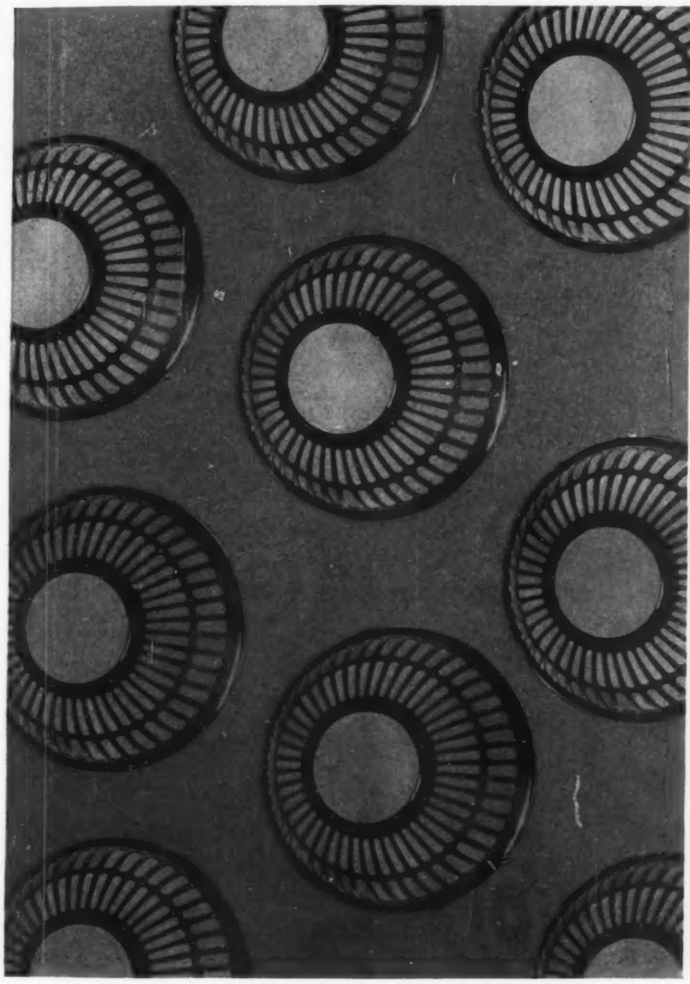

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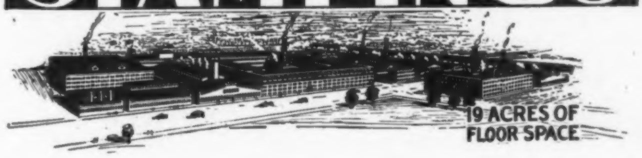

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ing against the bottom face of the mat of cane extracts the metal pieces as they pass in close proximity to it. It is while the mat is passing to chute 10 and contacting with the shell 1, which is magnetized by the core 8, that the metallic foreign matter is withdrawn.

Adhering to the peripheral face of the rotating shell, the metal pieces are carried until the strength magnetism is automatically reduced, thereby releasing them into a suitable receptacle.

Review of Noteworthy Patents

Other patents pertaining to design are briefly described as follows:

BALANCED THRUST BEARING—1,734,223, comprising in part a cylindrical ring fitting in a notch of the pressure ring, a series of balancing levers pivoted on the base of the casing, the ring bearing on the outer ends of the levers. Assigned to John M. Melott, Los Angeles, Calif.

SPRING SHACKLE—1,739,025, granted for an extension shackle connecting two movable members. The mechanism comprises an elastic nonmetallic swinging element having opposite portions connected to movable members, a rigid retaining wall on each side of the swinging element, and tie means extending laterally through the element for clamping the retaining walls in place. Assigned to Inland Mfg. Corp., Dayton, O.

PIPE COUPLING—1,738,915, for an invention of a coupling sleeve having one end connected to the hard metal pipe and provided at its opposite end with a socket receiving one end of the ductile metal pipe. The sleeve has an interior integral annular shoulder forming an abutment for the end face of the ductile metal pipe therein. Assigned to Mueller Co., Decatur, Ill.

VALVE—1,739,015, relates to a valve, a casing, a boss fixed within said casing and having its free end constituting a piston, the boss being provided with a peripheral valve seat spaced from the free end and above the fixed end. The outside diameter of the seat is less than the diameter of the piston. A cylinder fits the piston and has one end closed, the other end formed to seat on the operative portion of the valve seat. Means are employed to admit fluid under pressure to the space in the cylinder above the piston. Assigned to Dri-Steam Valve Corp., New York.

BALANCING MACHINE—1,739,105, is a counter-balancing head for balancing machines and comprises two balancing weights adapted to be moved at right angles to each other. The invention incorporates means for radially adjusting the position of the weights while the balancing head is rotating. Assigned to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FUEL PUMP—1,738,786, for "a pressure-responsive pumping organization, including a reciprocable pumping element provided with pressure-responsive resilient means for advancing the same, and with an attached handling element for retracing the same." In addition the invention comprises a uniform throw actuating element, a thrust refusing means interposed between the handling element and reciprocatory element and is in the form of a flexible link, the straightening of which gives a fixed inner limit to intake strokes imparted by the actuating element. Assigned to A C Spark Plug Co., Flint, Mich.

SEEDING MACHINE—1,735,232. "In a seeding machine, a driving axle, a hanger pivotally mounted on the axle, a gear wheel supported by the hanger, gearing on the axle meshing with said gear wheel, a feed-run shaft, gearing on shaft meshing with the gear wheel on hanger, a rock-shaft, and a link connecting the hanger and rock-shaft whereby when the latter is actuated said link will be projected or retracted and swing the hanger to disengage or engage the gear wheel carried thereby with the gearing on the feed-run shaft." Assigned to J. I. Case Co., Racine, Wis.

STARTER FOR ENGINES—1,735,250, for a driving mechanism consisting of means for moving a transmission member into engagement with a driven member and for automatically returning the transmission member from engagement with the driven member to normal position when the driven member is actuated. Assigned to Industrial Research Corp., Toledo, O.

CALENDAR OF MEETINGS

Jan. 11-18—American Road Builders association. Annual convention and road show at Atlantic City. Charles M. Upham, National Press building, Washington, is director.

Jan. 20-24—Society of Automotive Engineers. Annual meeting at Detroit. Coker F. Clarkson, 29 West Thirty-ninth street, New York, is secretary.

Jan. 27-31—American Institute of Electrical Engineers. Annual winter convention in New York. F. L. Hutchinson, 33 West Thirty-ninth street, New York, is secretary.

Feb. 7-8—American Society for Steel Treating. Semi-annual meeting at Hotel Pennsylvania, New York. W. H. Eisenmann, 7016 Euclid avenue, Cleveland, is secretary.

Feb. 15-23—International Aircraft Exposition. To be held in St. Louis.

Feb. 18-20—Society of Automotive Engineers. Technical meeting on aeronautics at St. Louis.

Mar. 5-7—American Society of Mechanical Engineers. Meeting at Hotel Stevens, Chicago. Calvin W. Rice, 29 West Thirty-ninth street, New York, is secretary.

April 5-13—All American Aircraft show. To be held in Detroit.

April 5-9—American Society of Mechanical Engineers. Fiftieth anniversary celebration. Opens in New York, April 5; afternoon in Hoboken; April 6 in New York; April 7, 8 and 9 in Washington at the Mayflower hotel. Calvin W. Rice, 29 West Thirty-ninth street, New York, is secretary.

May 12-16—American Foundrymen's association. Annual convention at Public auditorium, Cleveland. C. E. Hoyt, 222 West Adams street, Chicago, is executive secretary.

They call them "accessories" . . . . But try to get along without them!

CONTROL accessories are hardly accessories any more —so large a part do they play in keeping production up to top speed. Slow down or "spot" stopping of a hoist or lift table, provision against crane over-travel, protection to equipment and motors . . . these are often as important as getting your equipment into motion.

Such considerations warrant unusual care in the selection of control accessories. Whether they will operate or not can never be left to chance. Control accessories must be *unfailingly* dependable . . . today, tomorrow, as long as they are on the job.

You can be certain that Cutler-Hammer Control Accessories will meet every requirement of yours . . . and more. For they are built to the highest standard of ruggedness, durability and reliability. And supervising their design and construction every step of the way are the experience and engineering knowledge gained in over 30 years of intimate contact with Industry's needs. The insignia "C-H" is your guarantee of satisfaction. You are invited to investigate the design, construction and workmanship of C-H Control Accessories. A letter will bring you complete information.

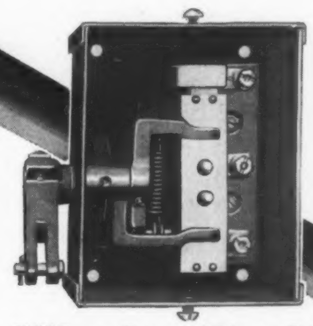
CUTLER-HAMMER, Inc.

Pioneer Manufacturers of Electric Control Apparatus

1320 St. Paul Avenue MILWAUKEE, WISCONSIN

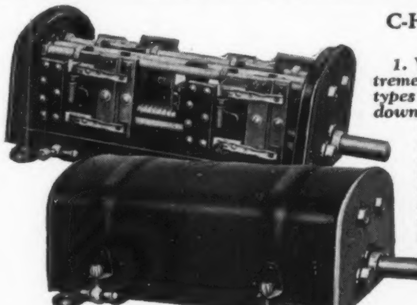
C-H Limit Switches
Bulletin 1271

1. Can be used on doors; machines, conveyors, etc. 2. Push-button, roller-lever or gravity operation. 3. Right or left-hand mounting normally open or normally closed contacts, for wide variety of uses. 4. Rugged construction for long service. 5. Easily renewable contacts. 6. Dust-proof case. 7. Double-break protection against shorts, etc. 8. Up to 600 volts capacity.



C-H Lever-Operated Master Switch
Bulletin 10252

1. Low voltage protection. Motor cannot restart after current failure unless switch goes through complete cycle. 2. Wide clearance between live parts—safety from shorts. 3. Non-stubbing contacts. 4. Extra long bronze bearings with convenient oil holes—low maintenance. 5. Simple construction. Few parts all ruggedly designed. Nothing but the shear pin can break in case of a jam for any reason. 7. Square operating lever shaft—four mounting positions—added adaptability. 8. Completely enclosed extra heavy case for safety. Cover removed by simply loosening screws. 6"x5"x4" deep—and handily placed conduit knockouts.



C-H Traveling Cam Limit Switch
Bulletin 14952

1. Wide range of adjustment, and extreme accuracy in stopping. Ideal for all types of hoists where accuracy of slow down and final stop is required—and for many other applications. 2. Double-pole contacts eliminate trouble from accidental grounds or shorts. 3. Contacts are all quick break type and when adjusted to the tripping point can be positively locked to that position by lock nuts. 4. Rugged construction throughout. All bearings bronze-bushed. Dust-proof cover. 5. Contacts and fingers are standard C-H construction and quality—long-lived, easily cleaned or replaced.

C-H Crane Safety Limit Switch—Bulletin 10111

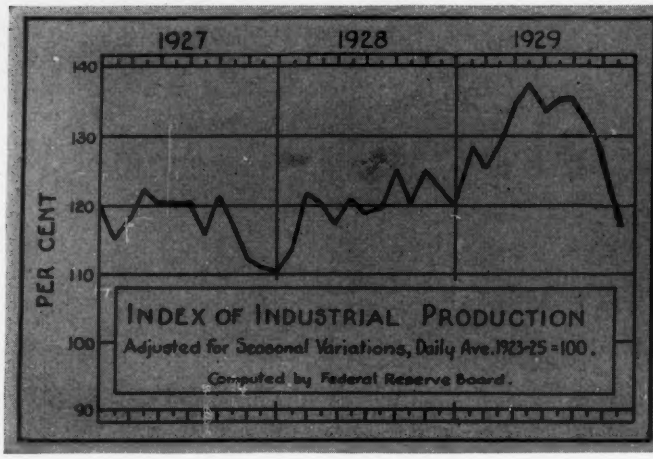
1. Small compact size—can be mounted in 4 positions. Easily wired. 2. Opens motor circuit, no pilot circuit required. 3. Dynamic braking assures quick positive stopping. 4. Quick acting contacts—automatic reset. Contacts and shields easily renewable—interchangeable with standard mill type contactor parts. 5. Ball bearings—rugged construction throughout—all wearing parts hardened. 6. Tripping weight an integral part of switch. Only one weight suspended. 7. Built in two sizes—smaller size shown.

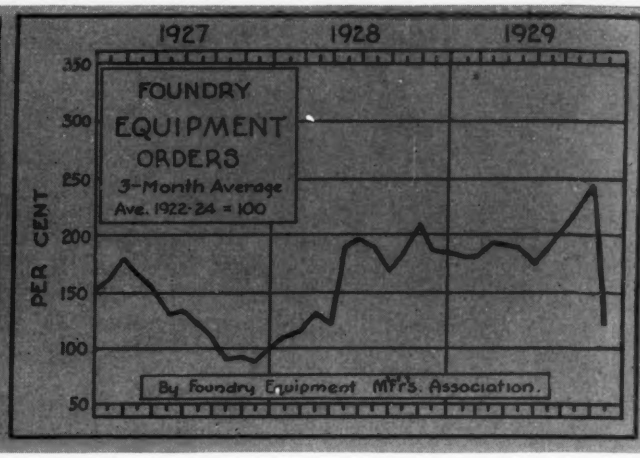
CUTLER HAMMER

C-H

The Control Equipment Good Electric Motors Deserve

(A283)

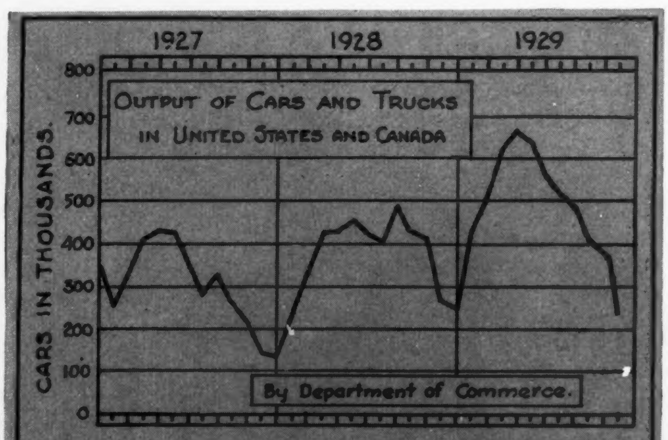




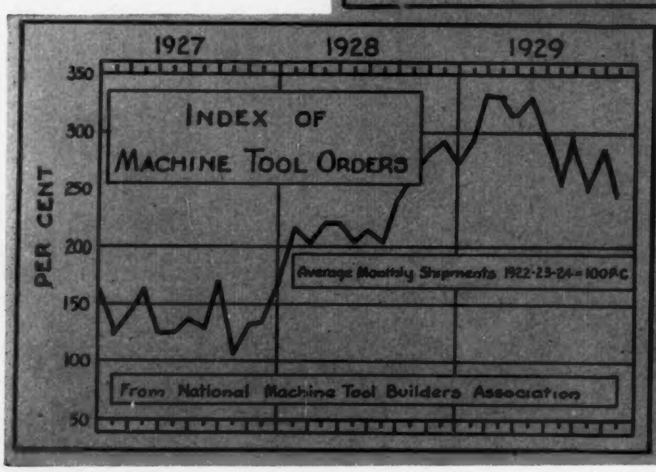
How Is Business?

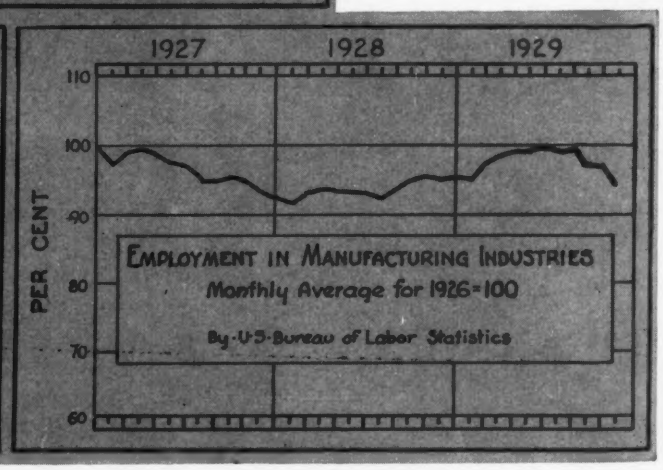
INDUSTRY enters a new year with a good record and a prosperous outlook. To 1929 is credited new high levels in production and earnings. Although a depression, caused by the stock market debacle, impeded progress in the closing months, in many departments confidence was maintained and an intrepid march through the morass kept business unafraid.

The consensus of opinion is that 1930 will almost measure up to the precedent set by the past year. It is believed that automotive production in 1930 will not be far short of 5,000,000 units or within 10 per cent of the 1929 record. Employment and wages promise to hold closely to the 1929 position, the highest in three years. With finance lending added impetus to the steel industry, the aspect of greater possibilities for 1930 appears favorable.



Mergers consummated during the past year gave 1929 the distinction of having more primary iron and steel capacity combined than any year since the United States Steel Corp. materialized in 1901. What in reality is in store for 1930 remains of course, a matter of speculation. However, one fact seems certain and that is the economies effected by the joining of forces in these divisions of industry will work to provide better material, more promptly, at less cost. Development in the forthcoming months augurs as many if not more of the agreeable surprises that characterized 1929, which shattered the alltime records of pig iron and steel ingot production.





MEN OF MACHINES

Personal Glimpses of Engineers, Designers, and Others Whose Activities Influence Design

FOR his contributions to the science and art of polyphase transmision of electrical energy, Charles F. Scott, professor of electrical engineering at Yale university, New Haven, Conn., has been awarded the Edison medal of the American Institute of Electrical Engineers. Prof. Scott was born at Athens, O., and received his collegiate education at Ohio university in that city, Ohio State university, Columbus, O., from which he was graduated in 1885, and Johns Hopkins university, where he engaged in graduate study. In 1888 he entered the employ of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and in 1897 was appointed chief electrician. He became consulting engineer of the company in 1904, and in 1911 was appointed to his present position at Yale university.

* * *

RESIGNING as consulting engineer and director of the Keystone Aircraft Corp. and director of the Curtiss-Wright Corp., Grover Loening will devote his entire time in future to his own company, the Grover Loening Co. Inc., of which he is president and chief engineer. This company will specialize in the development of new and advanced designs of aircraft. Starting in 1913 as assistant to Orville Wright, Mr. Loening is one of the oldest and most experienced engineers in the industry. In 1918 he founded the Loening Aeronautical Aviation corp. He won the Collier Trophy in 1920 for the development of the Loening air yacht and later he invented and developed the Loening Amphibian.

* * *

EFFECTIVE, Jan. 1, Erwin E. Dreese, formerly chief engineer of the Lincoln Electric Co., Cleveland, was appointed professor of electrical engineering at Ohio State university, Columbus, O. Prof. Dreese was graduated from the University of Michigan in 1920, and although only in his middle thirties he is regarded as one of the leading electrical engineers of the country. During the World war, which interrupted his studies, he served in the signal corps. Upon graduation from the university he became instructor in that school in electrical engineering, remaining for four years and simultaneously working for a master of science degree, which was conferred upon him in 1924. A year after joining the Lincoln Electric company where Prof. Dreese has been employed for the past five years, he was made chief engineer.

* * *

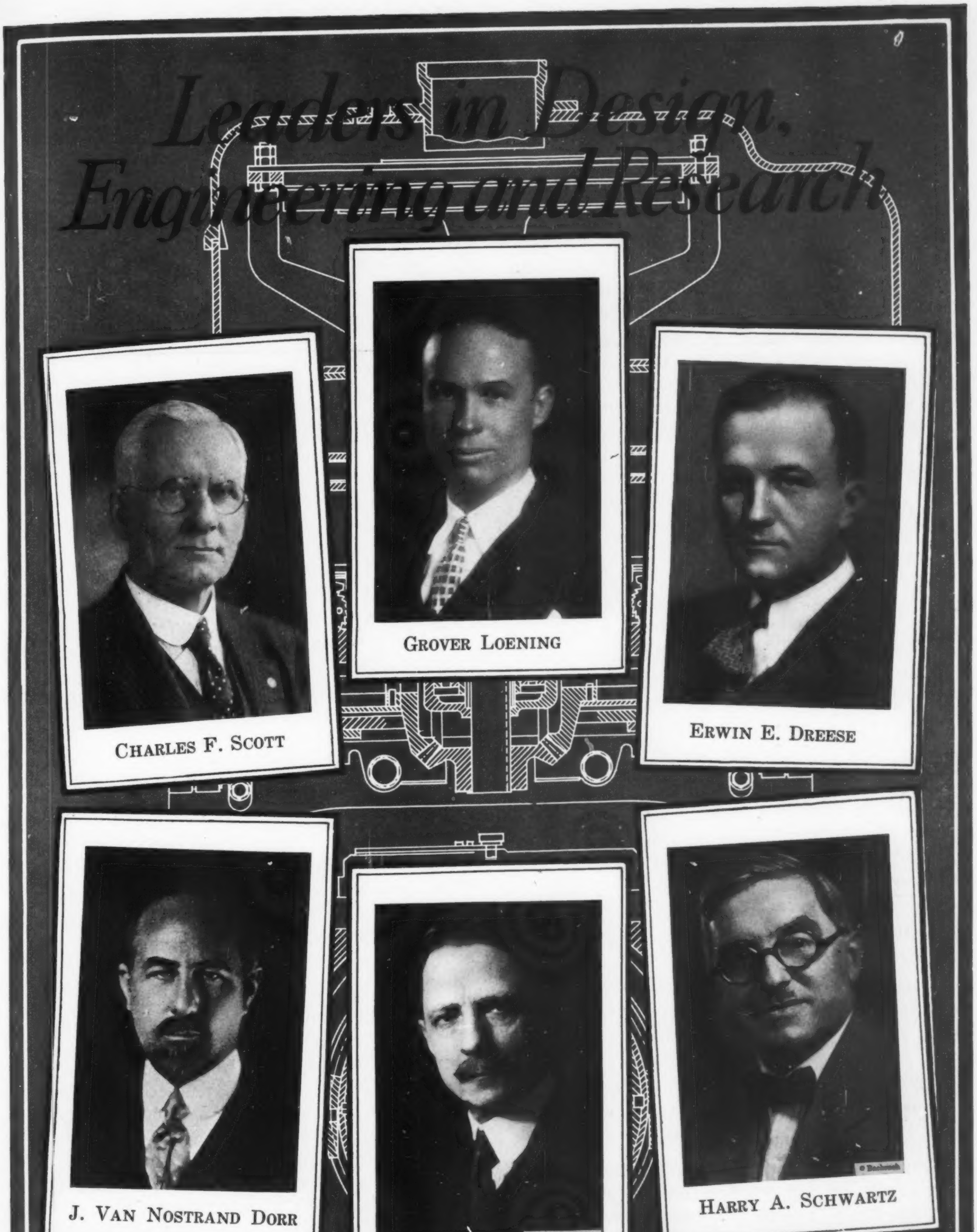
IN RECOGNITION of his invention of apparatus and achievement in developing and improving hydrometallurgical practice, John Van Nostrand Dorr, prominent chemical and metallurgical engineer, has been awarded the James Douglass medal of the American Institute of Mining and Metallurgical Engineers. After an early association with chemistry in the laboratory of Thomas A. Edison, Dr. Dorr was graduated from Rutgers university and engaged in metallurgical work in South Dakota and Colorado, inventing and developing there the classifier, thickner and agitator which bear his name. He is active in the professional chemical societies and is president of The Dorr Co. Inc., New York.

* * *

ANNOUNCEMENT has been made of the appointment of A. G. Trumbull as chief mechanical engineer of an advisory committee consisting of chief mechanical officers of the Chesapeake & Ohio, Erie, Hocking Valley, New York, Chicago & St. Louis and Pere Marquette railroads. This committee will act in an advisory capacity in all matters relating to the design of new rolling equipment acquired by these roads. Graduating from Cornell university in 1899, Mr. Trumbull became engineer of tests in 1902 and in 1922 he was appointed chief mechanical engineer of the Erie railroad, in which position he served until recently.

* * *

SELECTION of Harry A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland, to receive the John A. Penton gold medal, has been made. This 1930 major award of the American Foundrymen's association is being presented to Mr. Schwartz for his outstanding contributions to the foundry industry. He is a graduate of Rose Polytechnic institute, Terre Haute, Ind., and a member of a number of


Leaders in Design, Engineering and Research
Grover Loening
Charles F. Scott
Erwin E. Dreese
J. Van Nostrand Dorr
A. G. Trumbull
Blank & Stoller
Harry A. Schwartz

engineering societies, including the American Foundrymen's association with which he has been closely identified for a number of years as a contributor of papers and as chairman of a number of committees. At present he is serving as special lecturer on the metallurgy of cast iron at Case School of Applied Science, Cleveland, and advisor on malleable iron for *The Foundry*, in addition to his other activities and his connection with the National Malleable & Steel Castings Co.

* * *

Charles M. Nuckolls has resigned his position with the tractor works of the Internationl Harvester Co., Chicago, to become affiliated with H. D. Conkey & Co., Mendota, Ill. He will have charge of design and development work in the crane department. Prior to his affiliation with the International Harvester, Mr. Nuckolls was associated with the Whiting Corp., Harvey, Ill., and the Shaw Crane Works, Muskegon, Mich.

* * *

C. H. McL. Burns has been appointed manager of the engineering department of the Dodge Mfg. Co. Ltd., Toronto, Canada. For some years Mr. Burns was with the Link-Belt Co., Indianapolis, and just previous to his present appointment, was in charge of design of the materials handling equipment for the new mill and smelter of the International Nickel Co. at Copper Cliff, Ontario.

* * *

E. R. Weber, formerly assistant chief engineer of the R. D. Nuttal division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has resigned that post to become associated as chief engineer with the Thomas Spacing Machine Co., Pittsburgh, manufacturers of structural and bridge machinery.

* * *

John E. McCauley, recently re-elected president of the Steel Founders' Society of America, and noted in the December issue of MACHINE DESIGN, is vice president and general manager of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

* * *

Richard M. Mock has been appointed supervisor of design and construction of airplanes for the American market by the Ernst Heinkel Flugzeugwerke, Warnemunde, Germany. He was formerly aeronautical engineer with the Bellanca Aircraft Corp., New Castle, Del.

* * *

Frederick A. Brooks, recently associated with the Metropolitan Development Syndicate, Hollywood, Cälif., has been appointed chief engineer of the Apache Motor Corp., Van Nuys, Calif.

* * *

C. L. Burns recently was made assistant to Donald M. Brown, vice president in charge of manufacturing, Pratt & Whitney Aircraft Co., Hartford, Conn. Mr. Burns formerly was associated with American Machine & Foundry Co., Brooklyn, N. Y., on the development of automatic machinery.

* * *

Anthony H. G. Fokker returned recently from abroad where he spent the greater part of his time visiting his Dutch connections and studying aeronautical developments in Europe. Mr. Fokker is designer and consultant for the company which bears his name.

* * *

G. W. Blackinton has returned to the Sullivan Machinery Co., Chicago, of which he was chief engineer several years ago. Mr. Blackinton was formerly factory manager for the Continental Motors Corp., Detroit.

* * *

George A. Stetson has been made editor of *Mechanical Engineering* and *Transactions*, published by the American Society of Mechanical Engineers. Before joining the editorial staff in 1928, he was on the faculty of New York university.

* * *

L. S. Keilholtz has been made technical assistant to the president of the Frigidaire Corp., Dayton, O. He was formerly chief engineer.

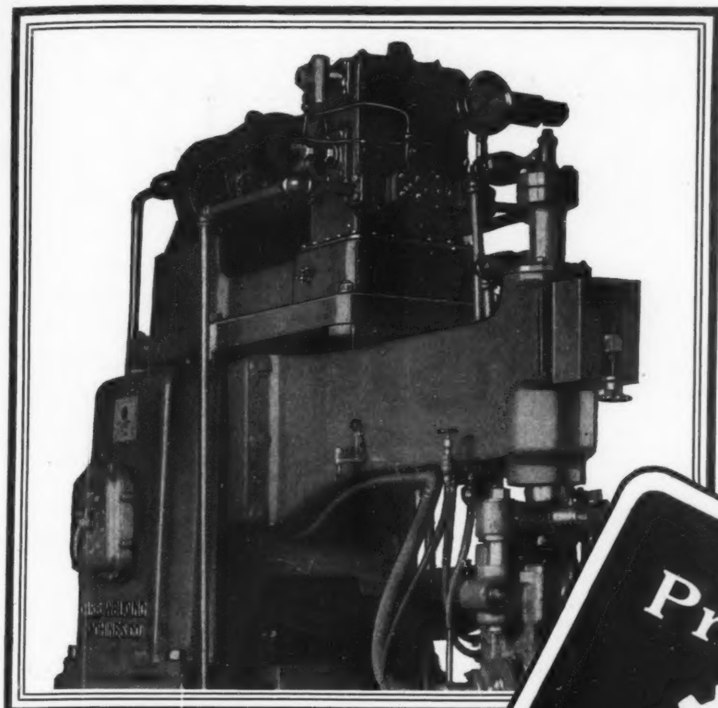
* * *

Ferdinand A. Bower has been made chief engineer of the Buick Motor Co., Flint, Mich. He was formerly assistant chief engineer.

Most moderate priced automobiles will have four-speed transmissions as standard equipment, declared H. C. McCaslin in viewing future automotive tendencies, at a recent meeting of the Canadian section of the Society of Automotive Engineers. He stated that probably the most pronounced improvement in 1929 and 1930 models was the adoption of four-speed transmissions having a noiseless third speed, or three-speed transmissions with noiseless second speeds.

McGraw-Hill Publishing Co., New York, has added another journal, *Product Engineering*, to its group of trade papers. For some time this new publication has been running as a monthly issue of *American Machinist*, and made its initial appearance in January as a separate publication.

This BETTER FEED Will Improve the Performance of *your* MACHINE TOOLS



Showing how Oilgear Equipment is mounted on Gibb Welder

BOTH the manufacturer and the user of machine tools benefit from Oilgear Drive.

Builders are able, by means of Oilgear, to provide automatic and semi-automatic functioning of machines with simple control mechanisms. They can fortify their machines against the guess-work that always attends rates of mechanical feeding. Oilgear Feeds are flexible. They are adjustable, steplessly, from minimum to maximum.

Users of Oilgear Feed-equipped machines get greatly increased production and service from tools. Oilgear's smooth, cushioned straightline motion, free from torsional vibration, is directly responsible. It also promotes increased dependability of the machine. Maintenance delays and expenses are amazingly reduced. Operation is simplified, and operators do better and faster work as a result.

Preference for Oilgear Feeds is spreading constantly. The growing demand of users is being met by manufacturers. There are more machine tools built today with Oilgear Feeds as standard equipment than ever before.

Write for special bulletins which describe Oilgear Feeds in detail.

The OILGEAR Company
675 Park Street   Milwaukee, Wis.

Oilgear Type "WE" Pump like that shown above, one of the many Oilgear types which provide for a great variety of applications

OILGEAR

THE PERFECT MACHINE FEED

Reg. U. S. OILGEAR Pat. Off.

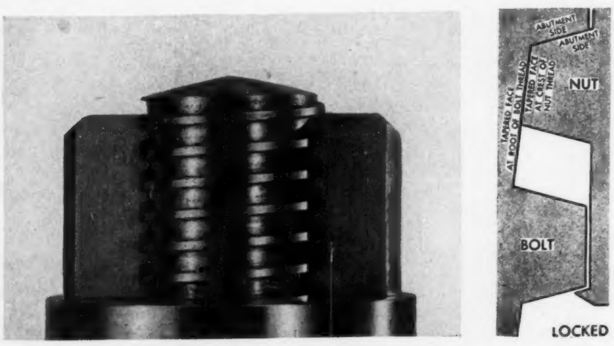
(A-1656)

NEW MATERIALS AND PARTS

Worthy of Note by Those Engaged In the Design of Mechanisms or Machines

Screw Thread Is Self-Locking

AMONG new developments recently announced is the self-locking screw thread of the Dardelet Threadlock Corp., 120 Broadway, New York. The principle of the locking feature lies solely in the profile of the thread. In the accompanying illustration the bolt and nut are shown in locked position. The faces of the threads are tapered about 6 degrees, pressure between the



Screw thread in locked position, pressure between the tapered faces providing the locking action

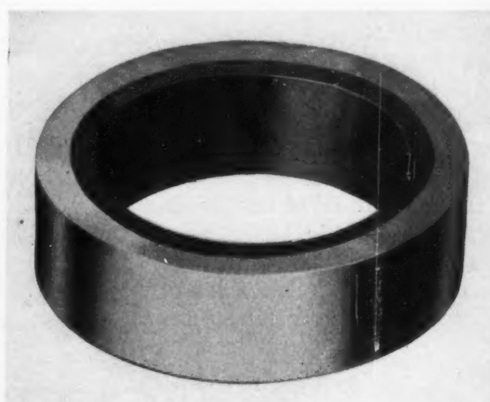
tapered facs providing the locking action. Square side of the thread prevent the nut from climbing the taper too far. Turning the nut back permits the tapered face of the nut thread to move down the tapered face of the bolt thread until the locking pressure is released.

New Iron Has High Permeability

HIGH permeability, low hysteresis loss iron is being marketed by A. Milne & Co., New York, under the trade name of "Swedelec." It is a Swedish charcoal Lancashire product made from pig iron and is a wrought or puddled metal possessing different properties from ingot metal. Smelting is done carefully at a moderate rate with relatively low temperature of blast. When the charge is ready it is beaten together under the hammer and rolled into billets which are afterwards reheated at a high temperature to again be rolled out to forms of iron of various dimensions. This product is used by manufacturers of railway signals, automatic safety control equipment, telephone switch board equipment, transformers, stock quotation instruments, etc. It has also found application in the airplane industry and in the manufacture of neon signs.

New Bi-metal Bearing Is Developed

A NEW bi-metal bearing developed by Fredericksen Co., Saginaw, Mich., and shown in the accompanying illustration, consists of an outer shell of seamless steel tubing to which an inner lining of bearing bronze is fused. The bearing bronze is a special metal produced by the company and is composed of virgin copper, tin and lead, with a high percentage of lead alloyed by a process which is claimed to prevent segregation of the lead as well as seizing, scoring, burning, corroding, pounding out and other ills. Tests of fusion of the metals have been made by bringing the entire bearing to the melting point of the bronze and allowing it to run out. Examination after cooling showed a film of the bronze adhering to the steel, showing that welding had taken place between the two metals. In the



Bi-metal bearing showing outer shell to which inner bronze lining is fused

process of manufacture the bearing metal is deposited on the steel shell by centrifugal force,

(*Concluded on Page 63*)

Directory of Iron, Steel and Nonferrous All

A

A-B-C; a weldable steel containing tungsten and chromium; Darwin & Milner, Inc., Cleveland.
ADAMITE; a wear resisting alloy for rolls and heavy duty castings; Mackintosh-Hemphill Co., Pittsburgh.
ADVANCE; for rheostats, resistance spools, thermocouples, etc.; nickel 45, copper 55 per cent; Driver-Harris Co., Harrison, N. J.
AGATHON; general brand name for alloy steels for resistance to wear, shock, stress and strain; Central Alloy Steel Corp., Massillon, O.
AMBRAC METAL; a corrosion-resisting alloy; nickel 20, copper 75, zinc 5 per cent; American Brass Co., Waterbury, Conn.
AMPCO METAL; an alloy resistant to high temperature and corrosion; copper 80 to 90, aluminum 8 to 10 and iron 6 to 7 per cent; American Metal Products Co., Milwaukee.
AMSCO; a high manganese steel; resistant to abrasion; for dipper teeth, draw bench chains, wheels, ball mill liners, etc.; American Manganese Steel Co., Chicago Heights, Ill.
ASCOLOY No. 33; an alloy resistant to abrasion and corrosion; chromium 12 to 16, nickel under 0.5 per cent; Allegheny Steel Co., Brackenridge, Pa.
ASCOLOY No. 44; an alloy resistant to high temperatures and corrosion; chromium 22 to 25 and nickel 10 to 13 per cent; Allegheny Steel Co., Brackenridge, Pa.
ASCOLOY No. 55 (chromium 26 to 30, nickel under 0.6 per cent); No. 66 (chromium 16 to 19, nickel under 0.5 per cent); an alloy resistant to corrosion, Allegheny Steel Co., Brackenridge, Pa.

B

BARBERITE; an alloy containing copper 88.5, nickel 5.0, tin and silicon 1.5 per cent; corrosion-resisting; Barber Asphalt Co., Philadelphia.
BIRDSBORO Nos. 26 and 30; No. 26 for its high physical properties and great strength; No. 30 for corrosion and fatigue-resisting; Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

C

CALITE; Grade "A" (carbon 0.80, nickel 35, chromium 15 per cent) a heat-resisting alloy for carburizing boxes, retorts and hearth plates; Grade "B," (carbon 1.50, nickel 6, chromium 18 per cent), for elevated temperatures; Calorizing Co., Pittsburgh.
CARPENTER Nos. 314, 317 and 408; chrome-nickel steels with chromium from 0.75 in No. 408 to 1.50 in No. 314 and nickel from 1.75 in No. 317 to 3.50 per cent in No. 314; for heat treated machine parts; Carpenter Steel Co., Reading, Pa.
CARPENTER No. 158 chrome-nickel steel (chromium 1.50, nickel 3.50 per cent); for case hardened machine parts; Carpenter Steel Co., Reading, Pa.
CARPENTER No. 626 chrome-nickel steel; an air-hardening steel for machine parts; Carpenter Steel Co., Reading, Pa.
CARPENTER STAINLESS, Nos. 1, 2, 3, 4 and 5; chromium steels for resisting heat and corrosion; Carpenter Steel Co., Reading, Pa.
CHROMAX; a heat-resisting alloy (nickel 35 and chromium 15 per cent); Driver-Harris Co., Harrison, N. J.
CHROME MAGNET; a 3.50 per cent chromium steel for magnets; Carpenter Steel Co., Reading, Pa.
CHROMEL No. 502; a heat-resisting alloy containing 30 to 34 nickel, 18 to 22 chromium and 38 to 48 per cent iron; Hoskins Mfg. Co., Detroit.
CIMET; a corrosion-resisting alloy in the form of bars and castings; for mine water pumps; chromium 25 and 75 per cent iron; Driver-Harris Co., Harrison, N. J.
CIRCLE "L"; a series of electric alloy steel castings for high strength, and resistance to wear, heat and corrosion; Lebanon Steel Foundry, Lebanon, Pa.
CNM; a chrome-nickel alloy possessing wear-resisting qualities; George H. Smith Steel Casting Co., Milwaukee.
COBALTCROM "PRK 33"; a nondeforming, airhardened steel; Darwin & Milner, Inc., Cleveland for bar stock and forgings; Detroit Alloy Steel Co., Detroit; for castings.
COLONIAL STAINLESS STEELS, Type "A" (chromium 14), "B" (chromium 16.50), "I" (chromium 14), "N" (chromium 18, nickel 8), "U" (chromium 18, nickel 8, copper 1.50 and molybdenum 1.50 per cent); for corrosion and heat-resisting purposes; Colonial Steel Co., Pittsburgh.
COLUMBIA STANDARD; a straight carbon steel; for mandrels, forming rolls, machine parts, hammers, etc.; Columbia Tool Steel Co., Chicago Heights, Ill.
CORROSOIRON; an acid-resisting iron; silicon 13.50, iron 85.5 per cent; Pacific Foundry Co., San Francisco, Calif.
CRISTITE No. I; a heat-resisting alloy (tungsten 17, chromium 10 and molybdenum 2.5 per cent); Commercial Alloys Co., San Francisco, Calif.
CROCAR; a heat-resisting alloy in the form of bars, sheets and wire; composed of chromium 12, vanadium 0.75 and cobalt 0.75 per cent; Vanadium Alloys Steel Co., Latrobe, Pa.
CRO-MOL; an alloy cast steel containing chromium and molybdenum; for hammer parts, rams, dies and sow blocks; Wheeling Mold & Foundry Co., Wheeling, W. Va.
CRUCIBLE STAINLESS STEELS; No. 12 (chromium 11.5 to 13.0 per cent), No. 18 (chromium 17 to 19 per cent), No. 24 (chromium 23 to 30 per cent), Grade "A" (chromium 12.5 to 14.0 per cent) Grade "B" (chromium 16.0 to 17.5 per cent); for corrosion-resisting purposes; Crucible Steel Co. of America, New York.
CUYO; stainless and heat-resisting steels in sizes from 1/16-inch round up to 2½-inch rounds, inclusive in all analyses; also special shapes, squares, flats, etc.; Cuyahoga Steel & Wire Co., P. O. Station D, Cleveland.
CYCLOPS No. 17; a noncorrosive steel for pump rods, still plugs, thermocouple wells, turbine blades, etc.; chromium 8, nickel 20 per cent; Cyclops Steel Co., Titusville, Pa.
CYCLOPS STAINLESS; Grade "A" (chromium 12.50, nickel 0.50 maximum); Grade "B" (chromium 17, nickel 0.50 maximum); Cyclops Steel Co., Titusville, Pa.

D

DARWIN COBALT MAGNET; a steel for permanent magnets containing cobalt; Darwin & Milner, Inc., Cleveland.
DAVIS METAL; a corrosion-resisting iron; for valves and fittings; carbon and silicon 0.5, manganese 1.5, nickel 29, iron 2, copper 67 per cent; Chapman Valve Mfg. Co., Indian Orchard, Mass.
DEFIHEAT RUSTLESS IRON; a corrosion-resisting alloy; chromium 25 to 30, manganese under 0.5, carbon 0.25 per cent and nickel a trace; Rustless Iron Corp. of America, Baltimore, Md.
DEFIRUST RUSTLESS IRON; a corrosion-resisting alloy; chromium 12 to 14, manganese under 0.5, carbon under 0.1 per cent and nickel a trace; Rustless Iron Corp. of America, Baltimore.
DEFISTAIN RUSTLESS IRON; a corrosion-resisting alloy; chromium 17 to 19, nickel 7 to 10, manganese under 0.5, carbon 0.2 per cent; Rustless Iron Corp. of America, Baltimore, Md.
DELHI HARD; a corrosion-resisting alloy in the form of bars; chromium 16.5 to 18, carbon 1 to 1.1, silicon 0.75 to 1, manganese 0.35 to 0.5 per cent; Ludlum Steel Co., Watervliet, N. Y.
DURALOY; "A" (27 to 30 chromium), "B" (16 to 18 chromium), "C" (12 to 14 chromium), "N" (21 to 24 chromium, 12 nickel), "18-8" (18 chromium, 8 nickel), "15-35" (15 chromium, 35 per cent nickel); for resisting corrosion; The Duraloy Co., Pittsburgh.
DURBAR; a high lead bronze bearing metal; Buffalo Bronze Die Cast Corp., Buffalo, N. Y.
DURIMET; B (nickel 35, chromium 12 per cent), A*b* (nickel 25 per cent), D*b* (nickel 15, and chromium 2.5 per cent); a heat and corrosion-resisting alloy; Duriron Co., Dayton, Ohio.

E

ELCOMET; a nickel-chromium steel alloy of high-silicon content; resistant to corrosion; for spinner heads, valves, pumps, etc.; La Bour Co. Inc., Elkhart, Ind.
ELVERITE; special castings with wear-resisting qualities; for tube mill linings, wheels, jaw crushers, sprockets, etc.; Fuller Lehigh Co., Fullerton, Pa.
ENDURO A; a heat-resisting alloy; chromium 16.5 to 18.5, silicon 0.75 and carbon 0.1 per cent maximum; Ludlum Steel Co., Watervliet, N. Y.
ENDURO, KA 2 (18 chromium, 8 nickel), AA (18 chromium), S and S-15 (13 per cent chromium); stainless irons resistant to heat and corrosion; Central Alloy Steel Corp., Massillon, O.
EVANSTEEL; a nickel-chrome alloy possessing wear-resisting qualities; for tractors, wheel castings, switch points, dies, ball mills, oil-pipe clamps, wheels, etc.; Chicago Steel Foundry Co., Chicago.
EVERBRITE; No. 90 (nickel 35, copper 60 per cent), for valves and chemical plants; No. 92 (nickel 35, copper 58 per cent), for high-pressure steam valves, chemical plants; Curtis Bay Copper & Iron Works, Baltimore.
EVERDUR, an acid-resisting alloy; silicon 4.5, manganese 1, copper 94.5 per cent; American Brass Co., Waterbury, Conn.

F

FAHRALLOY; contains from 28 chromium without nickel to 18 chromium and 70 per cent nickel; for all heat and corrosion-resisting purposes; Southern Manganese Steel Co. (Division of American Manganese Steel Co.), St. Louis.
FAHRITE; an alloy with heat-resisting qualities; for stirring arms, pots, retorts and furnace parts; The Ohio Steel Foundry Co., Springfield, O.
FARRELL'S 85; a molybdenum-chrome steel for resisting wear and abrasion and possessing high strength, toughness and rigidity; Farrel-Cheek Steel Foundry, Sandusky, O.
FIREARMOR; an alloy resistant to abrasion; nickel 60, chromium 20, iron 10, manganese 1.75, and carbon 0.5 per cent; Michiana Products Corp., Michigan City, Ind.
FIREX; a special alloy steel containing nickel and chromium; Darwin & Milner, Inc., Cleveland.
FLEXO; for springs and heat treated machine parts; Carpenter Steel Co., Reading, Pa.
FLINTCAST; an abrasion-resisting iron, Pacific Foundry Co., San Francisco, Calif.

H

HASTELLOY; A (nickel 60, molybdenum 20 per cent), (iron, molybdenum and nickel), D (nickel 90, copper 3, aluminum 1.5 per cent and silicon plus or minus 10); an alloy resistant to high temperatures and corrosion; Haynes Stellite Co., Kokomo, Ind.
HIOLOY; Grade W (resistant to abrasion), Grade SW (resistant to shock and abrasion), Grade CU (resistant to corrosion); The Ohio Steel Foundry Co., Lima, Ohio
HIPERNICK; a high-permeability alloy; for electrical usage; nickel and iron, 50 per cent each; Western Electric Co., Chicago.
HUBBARD SPECIAL; a nickel-chrome steel; for wear-resisting rolls and miscellaneous castings; Hubbard Steel Foundry Co., East Chicago, Ind.
HYB-LUM; a corrosion-resisting, general purpose alloy containing from 2 to 2½ per cent

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MACHINE DI

This list has been compiled from reports received
the assistance of designers. Additions to the list, a
will be made from time to time in the editorial

Alloys Used Frequently in Machine Design

chromium, nickel and other metals of the chromium group; and pure aluminum; Sheet Aluminum Corp., Jackson, Mich.

HYBNICKEL, "A," "B," "C," "D," "R" and "S"; a series of nickel-chromium alloys for heat and acid resistance; Victor Hybinette, Wilmington, Del.

HY-TEN-SL; a high strength bronze for engineering purposes; American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.

I

IDEOR; a special alloy containing tungsten and chromium; Darwin & Milner, Inc., Cleveland.

ILLIUM; a heat and corrosion-resisting alloy containing 60 nickel, 25 chromium, 7 copper, 4 molybdenum, 2 manganese, 1 silicon and 1 per cent tungsten; Burgess-Parr Co., Moline, Ill.

K

KINITE; a high-carbon and alloy steel; resistant to abrasion and compression; for dies, anvils, cutters, mandrels, machine parts, press tools, etc.; The Kinite Corp., Milwaukee.

KONEL; nickel 73, cobalt 17.5, iron 6.5, titanium 2.5 and manganese 0.2 per cent; an alloy in the form of bars, sheets and wire resistant to high temperatures; Westinghouse Research Laboratories, East Pittsburgh, Pa.

M

MANGANIN; for instrument shunts, resistance standards, etc. in wire form; manganese 12, nickel 4, copper 84 per cent; Driver-Harris Co., Harrison, N. J.

MAXTENSILE; a chrome-nickel iron; for hydraulic castings, sliding parts, spindles, couplings, sprockets, mill rolls, etc; Farrel-Birmingham Co., Ansonia, Conn.

MEEHANITE METAL; carbon 2 to 3, silicon 1 to 24, phosphorus 0.1, sulphur 0.04 to 0.14 per cent; a metal resistant to abrasion; Ross-Meehan Foundries, Chattanooga, Tenn.

MIDVALE; ATV I (nickel 33 to 39, chromium 10 to 12 per cent), ATV 3 (nickel 25 to 28, chromium 13 to 15 and tugnsten 3 to 4 per cent), BTG (nickel 60 to 62, chromium 10 to 11, and tungsten 2 to 2.5 per cent) HR (chromium 20, nickel 7, tungsten 4 per cent), V2A (chromium 17 to 19, and nickel 8 to 9 per cent); alloys in bar form resistant to high temperatures; Midvale Co., Philadelphia, Pa.

MIDVALE STAINLESS IRON; iron, 85 to 89, chromium 10 to 14, manganese under 0.5, and carbon under 0.13 per cent; an alloy resistant to abrasion, high temperatures, and corrosion; Midvale Co., Philadelphia.

MISCO, "Standard," "C" and "HN"; alloy steel containing various percentages of chromium and chromium-nickel; for heat, wear and corrosion-resistance; Michigan Steel Casting Co., Detroit.

MONEL METAL; a corrosion-resisting metal; manganese 2, nickel 67, iron 2, copper 28 per cent; International Nickel Co., New York.

N

NA; alloy steel castings, resistant to oxidation, corrosion and abrasion; National Alloy Steel Co., Blawnox, Pa.

NEVASTAIN A and B; stainless cutlery steels; chromium 14 and 17 per cent respectively, medium carbon; Ludlum Steel Co., Watervliet, N. Y.

NICHROME; nickel 60, iron 24, chromium 16, carbon 0.1 per cent; an alloy in the form of bars, sheets, tubing and wire; resistant to high temperatures; Driver-Harris Co., Harrison, N. J.

NICHROME IV; a heat-resisting alloy; composed of 60 to 80 nickel and 12 to 20 per cent chromium; Driver-Harris Co., Harrison, N. J.

NIROSTA; a nonrusting steel; chromium 18 and nickel 8 per cent; Central Alloy Steel Corp., Massillon, O., Ludlum Steel Co., Watervliet, N. Y., Firth-Sterling Steel Co., McKeesport, Pa.; boiler tubes, Babcock & Wilcox Tube Co., New York; pipe, Spang, Chalfant & Co., Pittsburgh; plates, Lukens Steel Co., Coatesville, Pa.

NITRALLOY; a chromium-molybdenum-aluminum steel capable of developing extreme hardness through nitriding; Central Alloy Steel Corp., Massillon, O.

NONCORRODITE; chromium steel castings; Millbury Steel Foundry Co., Millbury, Mass.

P

PERMALLOY; a high-permeability alloy for electrical usage; nickel 78, iron 22 per cent; Western Electric Co., Chicago.

PLYMITE; a tungsten alloy resistant to abrasion; P. L. & M. Co., Los Angeles, Cal.

PRESTO; a 1.40 per cent chromium steel for ball bearings, etc.; Carpenter Steel Co., Reading, Pa.

PYRASTEEL; a chrome-nickel-silicon alloy possessing heat-resisting qualities; for carburizing boxes, anealing pots, skid rails. Chicago Steel Foundry Co., Chicago.

PYROCAST; a nickel-chrome iron resistant to high temperatures; Pacific Foundry Co., San Francisco, Calif.

Q

Q-ALLOYS; resistant to abrasion and high temperatures; for hearth plates, rails, retorts, muffles, etc.; General Alloys Co., Boston, Mass.

R

RCF; a chrome-nickel alloy possessing wear-resisting qualities; George H. Smith Steel Casting Co., Milwaukee.

RESISTAC; an acid-resisting metal composed of 90 copper, 9 aluminum, and 1 per cent iron; American Manganese Bronze Co., Philadelphia, Pa.

REZISTAL; KA-2, Grade 2-B, 2-C, 4, 7, 255-C, 355-C and 2600; chromium-nickel alloy steels; resistant to high temperatures; Crucible Steel Co. of America, New York.

RITA; alloy steels for high strength, superior wearing qualities and toughness; Cannon-Stein Steel Corp., Syracuse, N. Y.

ROL-MAN MANGANESE STEEL; manganese 11 to 14, carbon 1 to 1.3 per cent; a manganese steel in bar, sheet and wire form; resistant to abrasion; Manganese Steel Forge Co., Philadelphia, Pa.

S

SAMSON; a chrome-nickel steel for heat treated machine parts; Carpenter Steel Co., Reading, Pa.

SMITHCO DYNAMO; an alloy steel possessing high magnetic permeability; George H. Smith Steel Casting Co., Milwaukee.

SPECIAL DEFIRUST RUSTLESS IRON; chromium 16 to 18, manganese under 0.5, carbon under 0.1 per cent and nickel a trace; an alloy resistant to abrasion; Rustless Iron Corp. of America, Baltimore, Md.

STANDARDALLOY; a chromium-nickel alloy (20 to 60 nickel, 16 to 25 per cent chromium); for heat-resisting purposes; Standard Alloy Co., Inc., Cleveland.

STELLITE; an abrasion-resisting alloy; cobalt 40 to 80, tungsten 0 to 25, chromium 20 to 35, and carbon 0.75 to 2.5 per cent; Haynes Stellite Co., Kokomo, Ind.

STERLING NIROSTA; a stainless resisting steel (carbon 0.15 and chromium 18.0 per cent) in strip, sheet, tube form and for articles to be hot forged or cold pressed; Firth-Sterling Steel Co., McKeesport, Pa.

STERLING STAINLESS STEELS, Types "A," "B," "T," "MG"; chromium steels with chromium from 12.50 in "T" to 19.00 per cent in "MG"; for cutlery, surgical and dental instruments, general machinery parts, etc.; Firth-Sterling Steel Co., McKeesport, Pa.

SWEETALOY; No. 16, a stainless iron for screw plugs, valves, etc.; No. 17, a high-chromium-nickel iron, acid resisting; No. 18, a high nickel-chromium iron, corrosion-resisting; No. 19, a high-chromium iron, abrasion resisting; No. 20 a high-nickel high-chromium iron, heat resisting; No. 21, a nickel and chrome alloy, heat resisting; No. 22, a high-chromium-nickel iron, acid resisting; Wm. J. Sweet Foundry Co., Inc., Irvington, N. J.

T

TANTIRON; a high-silicon iron alloy possessing corrosion-resisting qualities; Bethlehem Foundry & Machine Co., Bethlehem, Pa.

TEMPALLOY; heat-resisting steel; Duquesne Steel Foundry Co., Pittsburgh.

TIGERLOY; alloy steel castings for high strength, resistance to shock and abrasion; Massillon Steel Casting Co., Massillon, O.

TOBIN BRONZE; a corrosion-resisting metal; for pump shafts, propeller blades, etc.; copper 60, zinc 39.25, tin 0.75 per cent; American Brass Co., Waterbury, Conn.

TONCAN; an iron alloyed with copper and molybdenum; corrosion resistant; Central Alloy Steel Corp., Massillon, O.

TROPHET A; a corrosive resisting alloy; nickel 80, chromium 20 per cent; Grade "C," an alloy in the form of bars, sheets and wire; nickel 60, chromium 12 per cent and iron; resistant to high temperatures and corrosion; Gilby Wire Co., Newark, N. J.

TUFALOY; an alloy cast steel possessing a high yield point and wear resisting qualities; Fort Pitt Steel Casting Co., McKeesport, Pa.

U

UNILOY; No. 1, noncorrosive, heat resisting to 1600 degrees Fahr. (chromium 18, nickel 8 per cent); No. 2, noncorrosive, heat resisting to 1800 degrees Fahr. (chromium 21, nickel 12 per cent); Cyclops Steel Co., Titusville, Pa.

UNILOY; No. 1409, a noncorrosive stainless iron (chromium 12.50, nickel 0.25 per cent); No. 1809, a noncorrosive high-chrome stainless iron (chromium 18, nickel 0.50 per cent); No. 2825, a noncorrosive iron heat resisting to 2000 degrees Fahr. (chromium 28, nickel 0.50 per cent); Cyclops Steel Co., Titusville, Pa.

UNIONALOY; an iron base alloy; for mill guides, tube mill plugs, hopper liners; resistant to abrasion; Union Steel Casting Co., Pittsburgh.

UNIVAN; an alloy cast steel; resistant to shock and stress; vanadium 0.16 minimum, phosphorous and sulphur 0.05 per cent maximum; for locomotive frames, wheel centers, crossheads; Union Steel Casting Co., Pittsburgh.

W

WANDO; an oil-hardening steel; carbon 0.95, manganese 1.05, chromium 0.50, tungsten 0.50 per cent; Cyclops Steel Co., Titusville, Pa.

WEST; "60 Stancast," "75-Hy-Cast," "90-Dura-cast" and "110-Cum-Loy"; special alloy steel castings for a wide diversity of requirements; West Steel Casting Co., Cleveland.

Z

ZAMAK; a zinc-base die casting alloy; New Jersey Zinc Co., 160 Front street, New York.

ZORITE; nickel 35, iron 17, chromium 15, manganese 1.75, and carbon 0.5 per cent; resistant to abrasion and high temperatures; Michiana Products Corp., Michigan City, Ind.

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rts received from producers of alloys, for
to the list, and notifications of new alloys,
he editorial columns of MACHINE DESIGN

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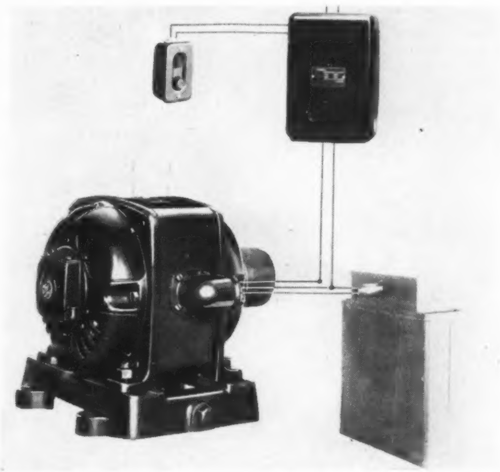
while the temperature of both metals is at the melting point of the former. This process is said to produce a uniform inner shell of bearing material.

New Motor Is Squirrel-Cage Type

GENERAL ELECTRIC CO., Schenectady, N. Y., announces a line of single-phase, squirrel-cage capacitor motors, designated type KC, especially designed for quiet operation. These motors are expected to find their principal application driving blowers and ventilating fans in buildings, on low-torque centrifugal machinery on low-pressure pumping applications, on some wood-

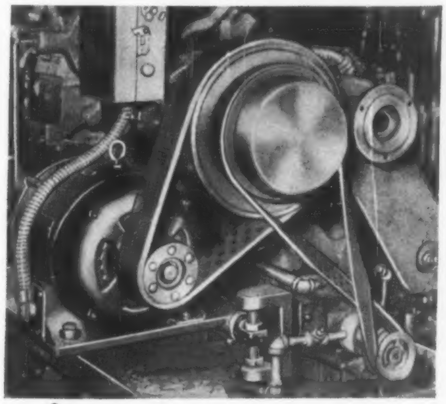


Single-phase, capacitor motor hooked into circuit

working machines and machine tools where the motor is built into the machine. Although the motor is classified as a single-phase machine, it is really a modified two-phase, squirrel-cage motor with a capacitor in series with one phase of the stator windings. This gives starting characteristics similar to the two-phase, squirrel-cage motor; that is, it is self-starting. The capacitor remains in the circuit throughout starting and running so that full-voltage hand or magnetic control only is required. As a result of this, single-phase pulsation is absent.

Belt Employs Vacuum Principle

EMPLOYING the vacuum principle, the Tak-Hold flat leather belt being marketed by the Slip-Not Belting Corp., Kingsport, Tenn., is available for transmitting power. In construction this belt consists almost entirely of leather and is made with a specially designed center which serves as a cushion and muffler. This cushion makes the vacuum pull highly effective. Special treatment of the cushion eliminates any whistle or unpleasant sound. The accompanying illustration shows a Tak-Hold uni-pull installation on a

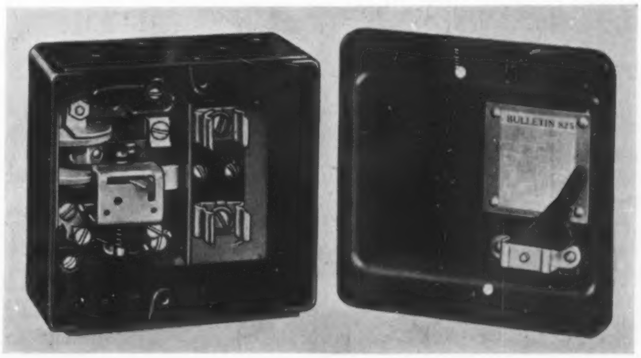


Typical installation of the new flat leather belt which uses vacuum principle

lathe operated by a 5-horsepower motor at 1200 revolutions per minute.

Small Overload Breakers Designed

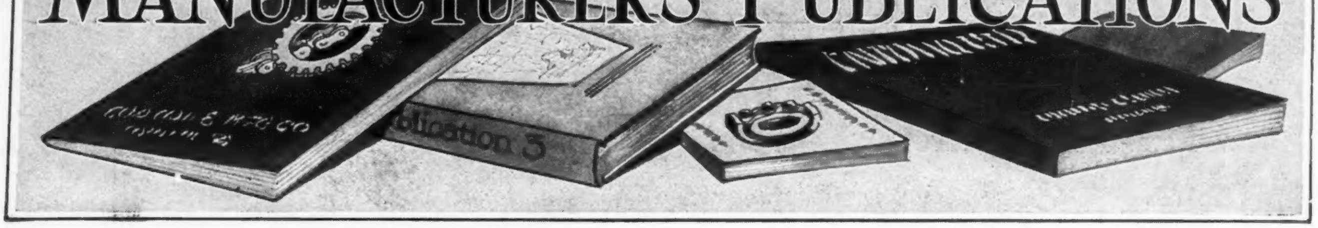
A LINE of small overload breakers for fractional horsepower alternating and direct-current motors has been developed by Allen-Bradley Co., Milwaukee. The Bulletin 825 breaker with fuse clips, shown in the accompanying illustration, is designed for motors of a maximum rating of 1 horsepower, 125 volts or $1\frac{1}{2}$ horsepower, 250 volts. These overload breakers can be obtained for single and polyphase motors, and with or without fuse clips and switch. The soldered rachet principle is employed. The overload setting cannot be changed without changing the heater element. Magnetic blowout coils are pro-



Mechanical details of small overload breaker equipped with fuse clips

vided to disrupt heavy arcs, enabling them to handle a locked rotor current.

MANUFACTURERS' PUBLICATIONS



BLUEPRINTING MACHINERY—C. F. Pease Co., Chicago, recently issued a 100-page catalog describing its line of blue printing machinery, drafting room furniture and blueprint paper. The catalog is illustrated with views of the machinery and furniture. Operation of the units is described in the text.

FLEXIBLE COUPLINGS—A 16-page booklet on the use and construction of the Diamond-Clark flexible coupling has been published by the Diamond Chain & Mfg. Co., Indianapolis. Illustrations show the extreme simplicity of this coupling and emphasize the ease of installation and disconnection. Photographs of applications and data on sizes and selection of couplings are included.

WELDING DESIGN—Lincoln Electric Co., Cleveland, has issued a bulletin on design in arc welding. It covers similarities and deviations in design as between riveting and welding. The publication is illustrated by sketches.

GEARS—Formica Insulation Co., Cincinnati, has issued a 36-page booklet describing its Formica silent shock-absorbing gears. Instruction and data as well as illustrations depicting the different types are given along with essential facts about Formica viewed from an engineering and technical standpoint.

VARIABLE SPEED TRANSMISSIONS—Lewellen Mfg. Co., Columbus, Ind., is distributing its catalog No. 25 containing 48 pages giving valuable information pertaining to problems of variable speed control. The catalog is tabulated and indexed. Lewellen variable speed transmission and control devices are described in detail by illustrations, descriptions and dimension tables.

HEAT RESISTING STEEL—Edgar Allen & Co. Ltd., Sheffield, Eng., has distributed a booklet on a steel of its production, design to resist high temperature, up to 1200 degrees Cent. The booklet contains full technical details and particulars of uses to which the steel can be put. Illustrations draw comparisons between this and other grades of steel after use in high temperatures.

ELECTRICAL APPLIANCES—Monitor Controller Co., Baltimore, has issued a bulletin on its automatic magnetic-reversing printing press controller, dynamic braking, for direct-current motors. Full description is given and illustrated.

BELTING—Akron Belting Co., Akron, O., has issued a bulletin on its leather belting for industrial uses, describing its advantages and the various grades supplied.

INSULATORS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a booklet on its apparatus insulators. These have a wide application in assembling switchgear assemblies, bus supports, disconnecting switches and the like. The bulletin gives information and test data on the company's new line of insulators of this type.

SPRING CHART—Danly Machine Specialties Inc., Chicago, is distributing the third revision on its spring chart for wall use. It covers a complete line of flat, round and square springs. The tables give data as to the size of hole in which the spring will work, inside diameter of the spring, size of wire, loading, maximum compression and other data.

ALLOY STEEL CASTINGS—Alloy Cast Steel Co., Marion, O., shows in a bulletin just issued the large variety of alloy steel castings it is equipped to produce.

COPPER AND BRASS—Revere Copper & Brass Inc., Rome, N. Y., is circulating illuminated copies of its advertising from magazines. In the effort to burn the Revere name deeply it is presenting a series of historical statements, illustrated with copies of old cuts of the time of Paul Revere & Son, direct ancestor of the present company.

AIRPLANE FORGINGS—National Machinery Co., Tiffin, O., has issued a leaflet calling attention to the special forgings it is producing for airplane service.

ENGINEERING GRAPHIC—Sullivan Machinery Co., Chicago, has started publication of a periodical under the title, Engineering Graphic, replacing Mine and Quarry, which has been published for several years. It will cover a wider field than the former publication.

SPEED REDUCERS—Janette Mfg. Co., Chicago, in a current bulletin, gives specifications of a worm-and-gear speed reducer and describes special designs for special conditions.

COMPENSATORS—General Electric Co., Schenectady, N. Y. has issued a leaflet containing data and description of its hand starting compensators for squirrel cage induction motors. It supersedes GEA-570A. Other leaflets simultaneously released describe the type RK group-operated disconnecting switch; Type EW resistors with data and superseding GEA-1142; and Type FK-20 oil circuit breakers, superseding 67433-A and 67711.

CHAIN DATA—An interesting and helpful pamphlet bearing the title "Chain for Cranes, Dredges and Heavy Duty" has just been issued by the American Chain Co. Inc., Bridgeport, Conn. It contains tables showing the number of links per foot, weights, proof tests and safe working loads of the different sizes of crane and dredge chain and other information which designers will find valuable for their files.

NONCORROSIVE CASTINGS—William J. Sweet Foundry Co., Inc., Irvington, N. J., specializing in noncorrosive and heat resisting castings, has a new enlarged chart for distribution which gives detailed information concerning analyses, physical properties, corrosive media and recommended uses of its castings.

STARTERS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a booklet on its linestarters for induction motors. The booklet describes and illustrates that equipment and shows several reproductions from photographs of typical installations. The various features of the linestarters and linestart motors also are discussed.